What’s New in IV Conduction?
(Quadrafascicular, not Trifascicular)

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etc......

I have no disclosures 😊
Case: 59 year old man with worsening exertional chest pain

- 26-Dec-2015: ER presentation; admit with unstable angina
- 27-Dec-2015: Stress PET scan showed large, reversible perfusion defect anterior, anteroseptal, anterolateral regions
- 28-Dec-2015: Coronary angio: 95% distal left main, 100% mid-LAD, and 95% ostial L-Cx
- 29-Dec-2015: ECHO: severe LV dysfunction; EF 20%
  - CABG: LIMA to LAD, two saphenous grafts to obtuse branches
- 2-Jan-2016: Discharged
KM: 59 year old man; 26 Dec 2015 (admission)

NSR; HR 70; PR 160 ms; QRS 110 ms; QT 400 ms; QRS axis -15° NSR, Antero-septal MI; ST-T abnormalities
KM: 59 year old man; 29 Dec 2015 (post-op)

NSR; HR 90; PR 170 ms; QRS 120 ms; QT 440 ms; QRS axis -40°; ST-T abnormalities;
“PAF” (Prominent Anterior Forces)
Differential Diagnosis...... ???
KM: 59 year old man; 1 Jan 2016
Time to go home!

NSR; HR 80; PR 120 ms; QRS 110 ms; QT 360 ms; QRS axis -20°; ST-T abnormalities

“PAF” no longer present!
Differential Diagnosis of “PAF” (R/S ratio in V1 or V2 ≥1)

- Normal variant: marked counterclockwise rotation (~1% prevalence)
- Misplaced precordial leads
- Dextrocardia with situs inversus
- Right ventricular and biventricular hypertrophy,
- True posterior myocardial infarction (new terminology: ‘lateral’ MI)
- WPW type ‘A’ (posterior located accessory pathways)
- Complete and incomplete RBBB (rSR’ with large R’ waves)
- Hypertrophic cardiomyopathy
- Muscular dystrophy (Duchenne’s)
- Left septal fascicular block (LSFB)……. What’s this?
What are those big R-waves in V1-3??

They may represent 'Left Septal Fascicular Block', dear

Let's talk about it
Los Hemibloqueos
THE HEMIBLOCKS

NEW CONCEPTS OF INTRAVENTRICULAR CONDUCTION
BASED ON HUMAN ANATOMICAL, PHYSIOLOGICAL,
AND CLINICAL STUDIES

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(I met him in 1969)
- rS complex in II, III, aVF
- S in III > S in II
- small q in I and/or aVL
- R in aVL > R in aVR
- LAD: -45 to -90°

Classic LAFB
Diagnosis: RBBB + LPFB + Old IWMI

- rS in I, aVL
- qR in II, III, aVF
- QRS axis +150°
- Notch in descending limb of R in III
- R in III > R in II
- q in III > q in II (if IWMI, q ≥ 40 ms)
- R/O isolated right heart disease

GN: 63 y.o. man (severe CHD, biventricular failure)
“The Conduction System of the Mammalian Heart” (1906)

Suano Tawara, MD

Figure 1: The Trifascicular Nature of the Left His System. The trunk of the left bundle branch (LBB) of the His bundle split in three fascicles: Left anterior fascicle (LAF), Left septal Fascicle (LSF) and Left Posterior Fascicle (LPF). “The Conduction System of the Mammalian Heart” (1906)
Variations on a LBB Theme

~65% human hearts have a third fascicle in the left bundle

LBB anatomy in 20 normal hearts

Br Heart J 1972;34:807-14
Durrer et al (Circulation 1970;41:899): (7 isolated human hearts)
Earliest activation of LV: (870 sites)
- Anterior paraseptal area (below MV)... left anterior fascicle
- Posterior paraseptal area..... left posterior fascicle
- Central (mid) left septal surface..... left septal fascicle
Left Septal Fascicular Block: Myth Or Reality?

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The History of Left Septal Fascicular Block: Chronological Considerations of a Reality Yet to be Universally Accepted

Andres Ricardo Perez Riera MD1; Augusto Hiroshi Uchida MD2; Edgardo Schapachn, MD3; Sergio Dubner, MD PhD FACC4; Li Zhang, MD5; Celso Ferreira Filho MD PhD6; Celso Ferreira MD PhD7; Dardo E. Ferrara MD8, Antoni Bayes de Luna MD PhD9, Paulo Jorge Moffa, MD PhD10

Electrovectorcardiographic Diagnosis of Left Septal Fascicular Block: Anatomic and Clinical Considerations

Andrés Ricardo Pérez Riera, M.D.,* Celso Ferreira, M.D., Ph.D.,* Celso Ferreira Filho, M.D. Ph.D.,* Adriano Meneghini, M.D.,*
ECG Criteria for LSFB: Prominent Anterior Forces (PAF)

- Normal frontal plane QRS axis
- Normal QRS duration (up to 110 ms)
- Increased intrinsicoid deflection $V_{1,2}$
- $R$ in $V_1 > 5$ mm
- $S$ in $V_2 < 5$ mm
- $R/S$ ratio in $V_{1,2} > 2$
- $R$ in $V2 > 15$ mm
- $R$ increasing $V_1$ to $V_3$, decreasing $V_{5,6}$
- Small q-waves in $V_{2,3}$
  - AND
- Clinically, exclude other causes of ‘PAF’
KM: 59 year old man; 29 Dec 2015 (post-op)

Normal frontal plane QRS axis
Normal QRS duration (up to 110 ms)
Increased intrinsicoid deflection V1,2
R in V1 > 5mm
S in V2 < 5mm
R/S ratio in V1,2 > 2
R in V2 > 15 mm
R increasing V1 to V3; decreasing V5,6
Small q-waves in V2,3

HR 90; PR 170 ms; QRS 120 ms; QT 440 ms; QRS axis -40°; ST-T abnormalities;
“PAF” (Prominent Anterior Forces)
### Blood supply of left branch fascicles

<table>
<thead>
<tr>
<th>Responsible system</th>
<th>LAF</th>
<th>LPF</th>
<th>LSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Branches of the LADA:</td>
<td>40 %</td>
<td>10 %</td>
<td>100 %</td>
</tr>
<tr>
<td>Double irrigation (ADA &amp; RCA)</td>
<td>50 %</td>
<td>40 %</td>
<td>0 %</td>
</tr>
<tr>
<td>Branches of the RCA</td>
<td>10 %</td>
<td>50 %</td>
<td>0 %</td>
</tr>
</tbody>
</table>

![Diagram of vessel distribution](image)
Another case of LSFB

Courtesy of:
Dr. Andres Ricardo Perez Riera
Following are the ECG criteria for the diagnosis of LSFB:

1) QRS duration < 120 ms, in general, close to 100 ms. The appearance of LFB does not increase QRSD by more than 25 ms, due to multiple interconnections between the fascicles of the LBB ("passage way zone" of Rosenbaum). The QRS complex is slightly prolonged between 100 ms to 115 ms (our case). Thus, LSFB pattern with a prolonged QRSD indicates the presence of additional conduction disturbances such as: other fascicular blocks, RBBB, MI, focal block, or a combination of these;

2) $\geq 15$ mm R waves in V2 (23mm) and V3 (17mm) or from V1: (our case)

3) Increasing of R wave for all intermediary precordial leads and decreasing from V5 to V6: (our case);

4) "r" wave jump may occur from V1 to V2 ("rS" in V1 for R in V2): (our case);

5) Absence of SAQRS shift: (our case);

6) Embryonic initial q wave V2-V3 (our case).

7) Absence of initial q wave in left leads because there are not first middle septal vector (our case).

Observation: all these criteria are valid in absence of RVH, septal hypertrophy or dorsal MI and other causes of PAF.
54 y.o. man with Class II angina: Exercise ECG test

- Hypertension
- Hyperlipidemia
54 y.o. man with Class II angina: C-Angio
10/22/2012: 44 year old man with severe aortic stenosis and bicuspid valve (pre-op ECG)

**ECG Diagnosis:** 1) LAE; 2) LPFB + LSFB (left bifascicular block); 3) LVH with strain
LSFB: Etiologies

- Coronary artery disease (left main and LAD distribution)
- Chronic Chagas’ cardiomyopathy (main cause of LSFB in Latin America)
- Hypertrophic Obstructive Cardiomyopathy (HOCM)
- Non-obstructive cardiomyopathy
- Aging conduction disease (Lev’s disease)
- Aortic valve disease
- Others
51 year old man with PAF: no history of heart disease
HR 67 bpm; PR 160 ms; QRS 106 ms; QRS axis -24°

Normal frontal plane QRS axis (yes)
Normal QRS duration (up to 110 ms) (yes)
Increased intrinsicoid deflection V1,2 (yes)
R in V1 > 5mm (yes)
S in V2 < 5mm (no)
R/S ratio in V1,2 > 2 (yes)
R in V2 > 15 mm (yes)
R increasing V1 to V3; decreasing V5,6 (yes)
Small q-waves in V2,3 (yes)
Absent q-wave in V5-6, I (yes)
24 year old man with PAF: no history of heart disease

HR 78 bpm; PR ms; QRS 102 ms; QRS +71 axis°
What are those big R-waves in V1-3??

They may represent 'Left Septal Fascicular Block', dear

Thank you!