ARRHYTHMIAS AMONG CONGENITAL HEART PATIENTS: NOT JUST THE KIDS ANYMORE

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DISCLOSURES

- NONE

COMMON PERCEPTION

- CONGENITAL HEART IS A "PEDIATRIC" DISEASE
- I'M AN INTERNIST
- I DEAL WITH A-FIB, CORONARY, AORTIC / MITRAL VALVE ISSUES
- I FELL ASLEEP DURING THE CONGENITAL HEART LECTURE
OVERVIEW

- US: >1,000,000 ADULTS WITH CHD (ACHD)
- EUROPE ~ 1,000,000 GROWNUPS WITH CH (GUCH)
- 20,000 CHD PATIENTS REACH > 21y AGE EACH YEAR

CARDIOLOGISTS MUST
- HAVE DETAILED KNOWLEDGE OF CONGENITAL HEART
  - BOTH REPAIRED AND NON-REPAIRED
  - INTRINSIC ISSUES OF HEMODYNAMICS AND ELECTRICAL
- UNDERSTAND SURGICAL PROCEDURES AND ASSOCIATED SEQUELAE

THINK AHEAD

Adult Congenital Heart Disease

Population
- Children With CHD
- Adults With CHD

1980
2000
2020

REALITY

~ 25000 CARDIOLOGISTS IN USA

SIMPLE MATTER OF LOGISTICS
ACHD ARRHYTHMIA CONCEPTS

- CONGENITAL HEART DISEASE ENTAILS DIFFUSE CARDIOVASCULAR INVOLVEMENT
- A REPAIRED CONGENITAL DEFECT DOES NOT IMPLY A "NORMAL" HEART....
- SURGERY CAUSES INCISIONS, INCISIONS CAUSE SCARS, AND SCARS CAUSE ARRHYTHMIAS....

CIRCULATION 2002; 105: 2318

WHO IS AT RISK?

- SUDDEN DEATH IN REPAIRED ACHD

- TETRALOGY OF FALLOT
- D-TRANSPOSITION
- L- TRANSPOSITION
- AORTIC STENOSIS
- COARCTATION
- SINGLE VENTRICLE
- EBSTEIN'S ANOMALY
- SEPTAL DEFECTS

IN OTHER WORDS...MOST PATIENTS

Survival Following CHD Surgery
SCOPE OF THE PROBLEM

Adult Congenital Heart Disease
Emergency admissions-cardiovascular

- Arrhythmias
- Heart failure
- Syncope
- Infections

- Others


ACHD ARRHYTHMIA EVALUATION

- UNDERSTAND THE CONGENITAL HEART ANATOMY
- PREDISPOSITION TO ARRHYTHMIAS
- UNDERSTAND SURGICAL PROCEDURE(S)
- INCIDENCE OF ARRHYTHMIAS
- RECOGNIZE INTRINSIC ECG FINDINGS
  - PRE-OP: QRS AXIS, MORPHOLOGY
  - POST-OP: BUNDLE BRANCH

ACHD ARRHYTHMIA EVALUATION

Surgical Shunts in CHD

Surgical Procedures

-修补
-射频消融
-导管射频消融
-射频消融
-药物
-手术

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ACHD ARRHYTHMIA EVALUATION

**INTRINSIC PROBLEMS IN CONGENITAL HEART DEFECTS**
- **Atrial Septal Defects:**
  - Sinus Node Dysfunction
  - VSD / AV Canal:
    - AV Node Dysfunction, Abnormal QRS Axis
- **Ebstein's Anomaly:**
  - WPW / Arrhythmias
- **L-TGA:**
  - AV Block, Abnormal QRS
- **Single Ventricle:**
  - Abnormal QRS
  - Abnormal Coronary:
    - Infarct Pattern

**POST REPAIR CONGENITAL HEART PROBLEMS**
- **ASD:**
  - Sinus Dysfunction, Flutter
- **VSD / AV Canal:**
  - AV Block, VTach
- **Tetralogy of Fallot:**
  - VTach, Flutter
- **D-TGA (Mustard):**
  - Sinus Dysfunction, Flutter, VTach
- **Single Ventricle / Fontan:**
  - Sinus Dysfunction, Flutter (IART)
- **Ebstein's Anomaly:**
  - SVT, Flutter, AV Block
- **Aortic Stenosis / Coarctation:**
  - Ischemia, VTach, AV Block

**SURGERY = INCISIONS = SCARS = ARRHYTHMIAS...**

**REENTRY PATHWAYS**
ATRIAL SEPTAL DEFECTS

AV NODE, CONDUCTION SYSTEM

PERI MEMBRANOUS VSD
VSD / AV CANAL

- AV CONDUCTION
  - INTRINSICALLY DISPLACED
    - ABNORMAL QRS AXIS
  - DAMAGE ACUTELY OR EVEN YEARS AFTER SURGICAL REPAIR
  - FIBROTIC TISSUE INGROWTH
  - EITHER PROGRESSIVE AV DELAY OR ABNORMAL TACHYCARDIAS

ECG INTERPRETATION PITFALLS IN ACHD

Typical post-op VSD / Tetralogy of Fallot repair
Distal conduction damage

- Anterior infarct
- Pulmonary embolism
- Infection / inflammation
- Right bundle branch block

ECG INTERPRETATION PITFALLS IN ACHD

Ventriculotomy through distal Right Bundle
PO VSD with pre-existing RBBB and AVNRT due to late fibrotic changes in the AV Node region.
Wide QRS, ventricular tachycardia

Repaired AV Canal:
Intrinsic Left Axis
PO RBBB
1o AV Block

= Trifascicular disease
Needs pacemaker
1o AV Block
Right Bundle Branch Block
Left Axis

RSR' in lead V1
q waves in leads 1, AVL
ST-T abnormalities
qR across precordial leads
-RV conduction delay

Antero-septal Infarct
Normal Dextrocardia
ECG INTERPRETATION PITFALLS IN ACHD

QRS Right Axis
Right Ventricular Hypertrophy
Atrial paced

PO d-TGA/Mustard
Sinus node dysfunction common
= Pulmonary hypertension

V1
Sinus tachycardia
Bundle branch block

Right Bundle
Left Axis
1st AV Block

Single Ventricle
Intra-atrial Reentrant Tachycardia
Anterolateral infarct
ECG INTERPRETATION PITFALLS IN ACHD

Dual chamber pacing: A sense / V pace
Rate 90/min

PO Single Ventricle / Fontan
2:1 IART (Atrial rate ~180/min)

ENLARGED RIGHT ATRIUM

Thick atrial wall

PREDISPOSITION TO ATRIAL ARRHYTHMIAS
IART = SLOWER COUSIN OF FLUTTER
TYPICALLY NON-AMENABLE TO CATHETER ABLATION
ECG INTERPRETATION PITFALLS IN ACHD

- Mild pre-excitation / WPW
- Congenital heart block, dual chamber pacemaker septal-His bundle lead implant

ECG INTERPRETATION PITFALLS IN ACHD

- qR V1
- RVH
- Absent Q waves
- L-TGA
- Congenital Corrected

ADULT CONGENITAL HEART

- DEVICE INTERVENTION
  - UNDERSTAND THE CARDIAC ANATOMY
    - PRE-EXISTING AND SURGICAL
  - DON'T RELY ON ECHO
  - CT / MRI MAY DELINEATE ANATOMY, VASCULAR BETTER
  - RECOGNIZE POTENTIAL PROBLEMS BEFOREHAND
  - CHOOSE BEST APPROACH
    - TRANSVENOUS, EPICARDIAL, COMBINATION

Congenital Heart Disease 2011 Sep; 6(5):466-74.
DEVICE THERAPY

- VASCULAR ACCESS OR LACK OF
- CAN YOU GET THERE FROM HERE?
- DON'T ASSUME ANYTHING

DEVICE THERAPY

- ABSENT INNOMINATE
- ALTERED COURSE

D-TGA / MUSTARD ATRIAL BAFFLE
SVC ATRIAL BAFFLE OBSTRUCTION
DILATED AZYGOS

VASCULAR STENTING OF OBSTRUCTED BAFFLE

STENT vs PACING LEAD

A: STENT DIAMETER
B: EFFECTIVE DIAMETER
STENTING DOESN'T GUARANTEE CHRONIC PATENCY

THE WAVE OF ADCH PATIENTS IS COMING.....BE PREPARED

THANK YOU

Yes, this is Detroit in January!