1

Jesse E Edwards Registry of Cardiovascular Disease

Shannon Mackey-Bojack, MD

2

Jesse E Edwards, MD

- Education and training, MA and NY
- Research fellow NIH (1940-42)
- Army, WWII (1942-46) Commanding Officer, Central Laboratory
- Mayo Clinic (1946-1960) – assigned the cardiovascular system

3

Mayo years

- At the time, the only CV surgery performed was ligation of PDA
- No BT- shunts had yet been performed.
- Pediatric Cardiology didn't exist as a specialty.

4

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- No BT- shunts had yet been performed.
- Pediatric Cardiology didn't exist as a specialty.
- 1947 given 105 autopsy specimens of congenital heart disease collected since the Clinic began.

5

Collaborative effort, people with specialized interests worked together

- Cardiologists joined the review- Howard Burchell, Thomas Dry and Robert Parker.
- Correlated findings with cardiac catheterization -Earl Wood
- Worked with medical illustrator- Russel Drake
- Expanded to include CV surgery – John Kirklin
- Eventually the specialty of pediatric cardiology evolved – John DuShane

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Led to the classification of cardiac malformations according to morphology and function

7

Miller Hospital

- Moved to St Paul 1960 became Chief of Pathology at Miller Hospital
- With the help of Russel Lucas, developed a training program in CV pathology at the University of Minnesota.
- In the basement of Miller Hospital, began a collection of hearts that would eventually lead to the Jesse E Edwards Registry of Cardiovascular Disease.
  - Surgeons, pediatricians, internists, radiologists and pathologists from around the country and world came to study with Dr. Edwards.
  - The graduates subsequently became known as
    "the graduates of the Miller Hospital Basement."

8

The afternoon teaching sessions

- Autopsy hearts from children with congenital heart disease.
- Medical students/ residents/ fellow "assigned" a heart for review.

9

Legacy

Recognized as the first person to correlate clinical and pathologic data in cardiovascular disease

10

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" a rational approach to therapy begins in each case with a fundamental understanding of underlying anatomy".

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" a rational approach to therapy begins in each case with a fundamental understanding of underlying anatomy.

Patients often get labeled "nonischemic cardiomyopathy" or "complex congenital heart disease", as if these labels were the end- point diagnosis.

12

Jesse E Edwards Registry of Cardiovascular Disease

- 1979 Miller and St Luke's Hospitals combined to form United Hospital
- The collection of hearts had grown and moved into it's own space in the St Paul Heart and Lung building and was officially called the Jesse E Edwards Registry of Cardiovascular Disease
- Directorship was taken over by Jack L. Titus in 1987.
  - Renowned cardiac pathologist that worked and trained with JEE at Mayo
  - Chief of Pathology at Baylor, Houston.

13

Evolution of the Registry

Cardiac Pathology Consult Lab

Jesse Edwards 1960-1987
Jack Titus 1987-2004

14

The Registry

Formation of “classification system”

- All findings including pathologic abnormalities, congenital abnormalities and incidental findings are identified.
- All findings are given a three digit “class number”.
- Major and minor class numbers are assigned based on the predominant finding, with all additional findings also coded.
- Class numbers are entered into an electronic database designed specifically for the JEE CV Registry.
- Allows for identification of cases based on their pathologic findings and allows the cases to be retrieved and re-examined.

15

Classification System

- Major Class
  - The most significant finding
    - Number system developed
    - Class 400 – Sudden Death
    - Class 510 – Atherosclerotic coronary artery disease
    - Class 620 – Aortic Dissection
- Minor Class
  - All other findings
    - Class 394 – myxomatous change in mitral valve

16

Specimens

- All routine referral hearts are retained indefinitely
  - Preserved in formalin
  - Stored in numerical order by year
- Any specimen may be returned by request of family or referring agency

17

Collection

- To date – over 40,000 cardiovascular specimens
- Collection includes ~15,000 permanently retained hearts
- Largest collection in the world
- Largest collection of unoperated congenital heart disease in the world
- Useable collection
  - All specimens are coded, cataloged and cross referenced

18

Uses of the Collection

- Teaching
- Research
- Medical innovation

19

Uses of the Collection

- Teaching
  - Medicine/surgery/pediatric – all spent rotations at CV Registry
    - Resident re-imbursement changes
  - PICU, NICU, Pediatric cardiology medical students, pathology residents and medical student and pathology resident elective
  - Forensic pathology fellow
- Research
- Medical innovation

20

Uses of the Collection

- Teaching
- Research
  - Being at Allina allows us to collaborate on any project with any institution or multiple institutions at once.
- Medical innovation

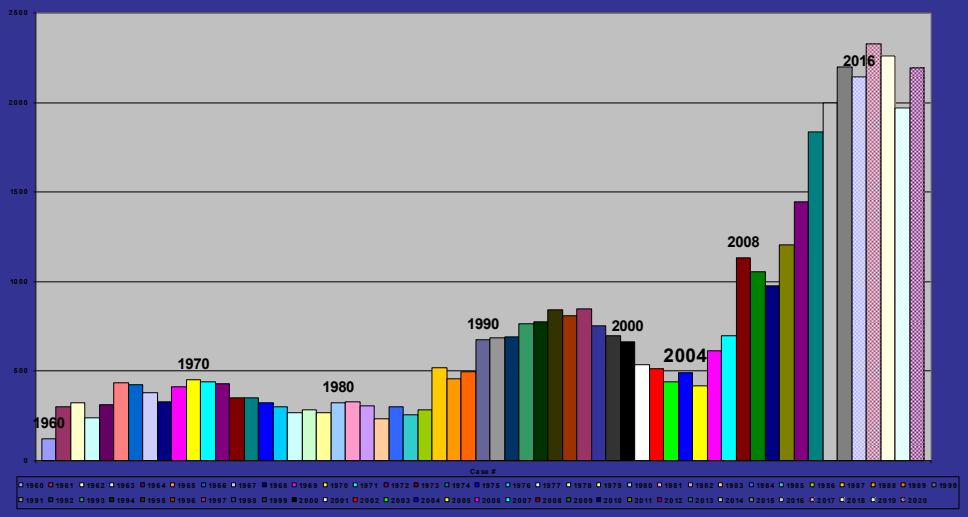
21

Uses of the Collection

- Teaching
- Research
- Medical innovation
  - Device companies utilize the collection for understanding anatomy and the variations in pathology, crucial for developing new devices
  - Review excised prosthetic valves to advance future versions
  - Examine hearts removed for tissue donation for use of human allograft valves

22

Working Laboratory



23

Types of cases

- Donor Hearts
- Routine cases
- Surgical specimens
- Explanted prosthetic valves

24

Donor Hearts

- Post valve recovery donor hearts
  - Examination of remnant heart after removal of pulmonic and aortic valves:
    - Cardiac pathology report with gross and histologic findings.
    - Retain remnant hearts for 6 mo.

25

Routine Cases

- Surgical specimens:
  - Excised valves or other tissues.
  - Endomyocardial biopsies.
  - Explanted hearts for transplantation.
- Referral hearts:
  - Congenital heart disease.
  - Medical examiner cases for evaluation of sudden death, conduction system studies, evaluation of complex conditions including postoperative cases, medical legal cases and assistance with homicide cases.
  - Hospital cases – unexpected death, complications, postoperative evaluations and family requests.

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Excised prosthetic valves

- Examination for compliance with FDA requirements for medical devices.

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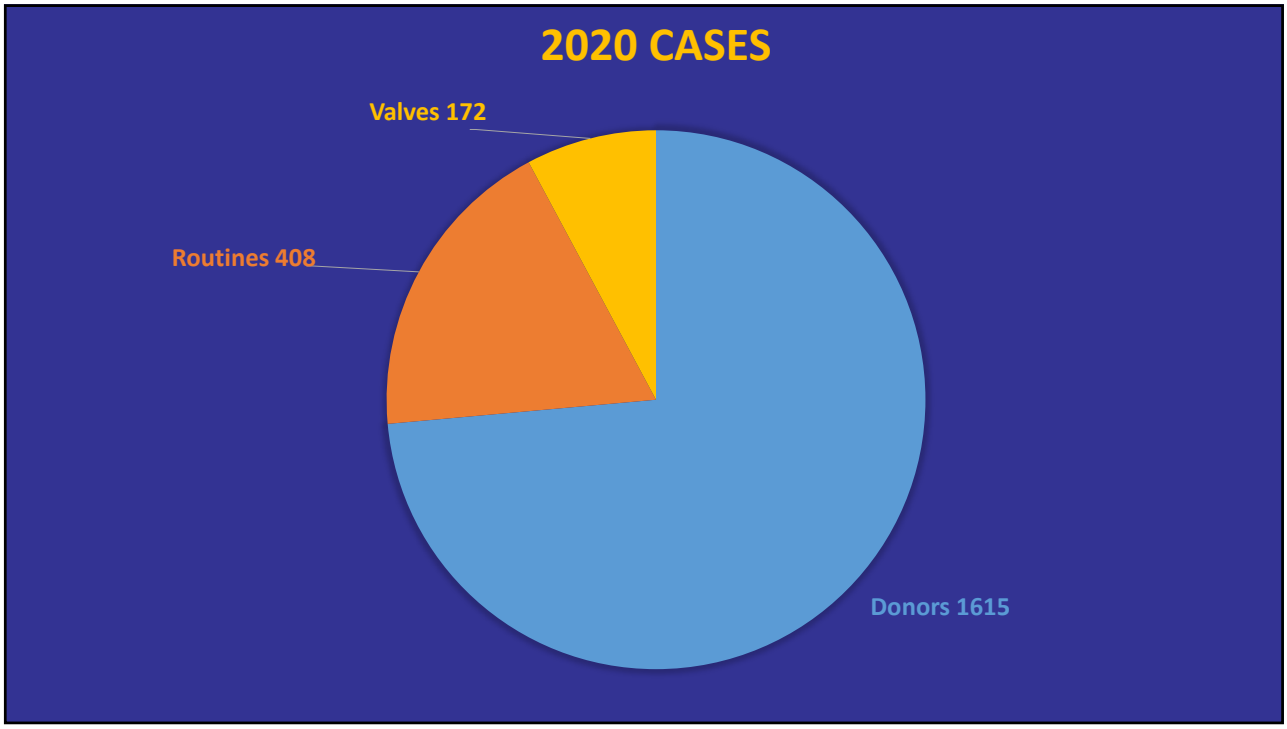

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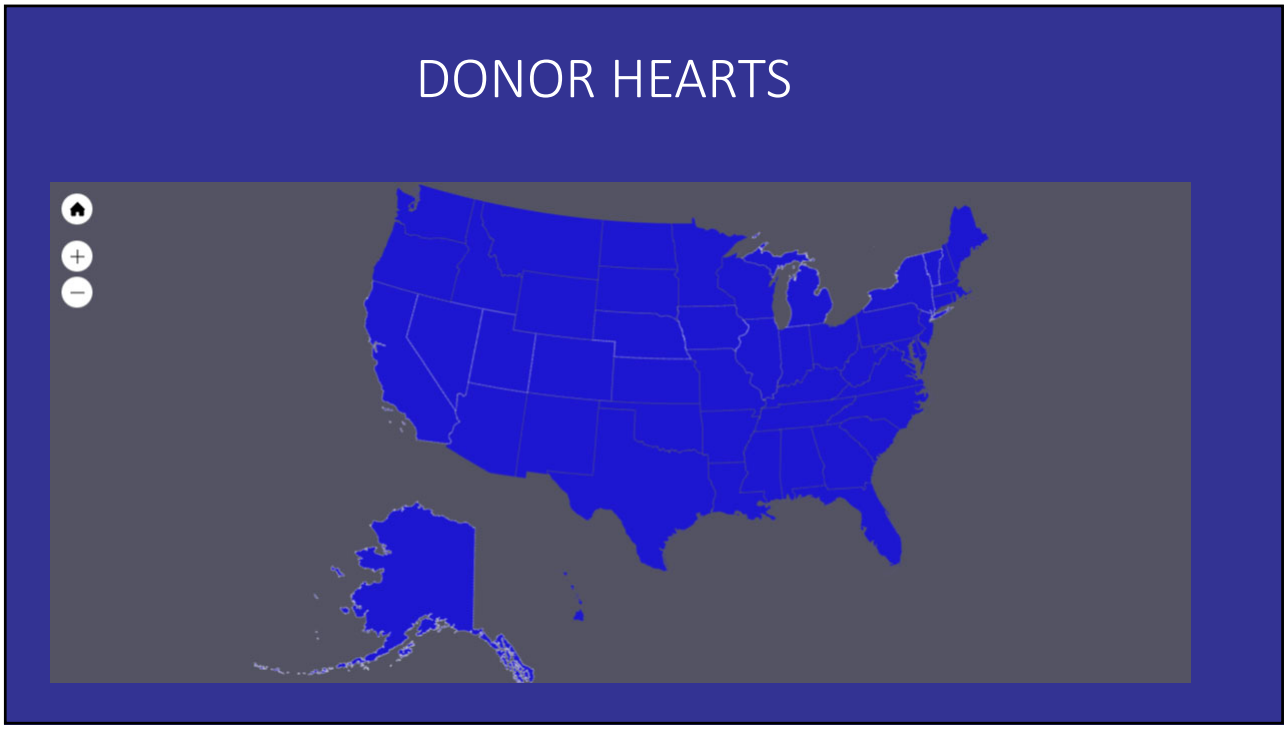

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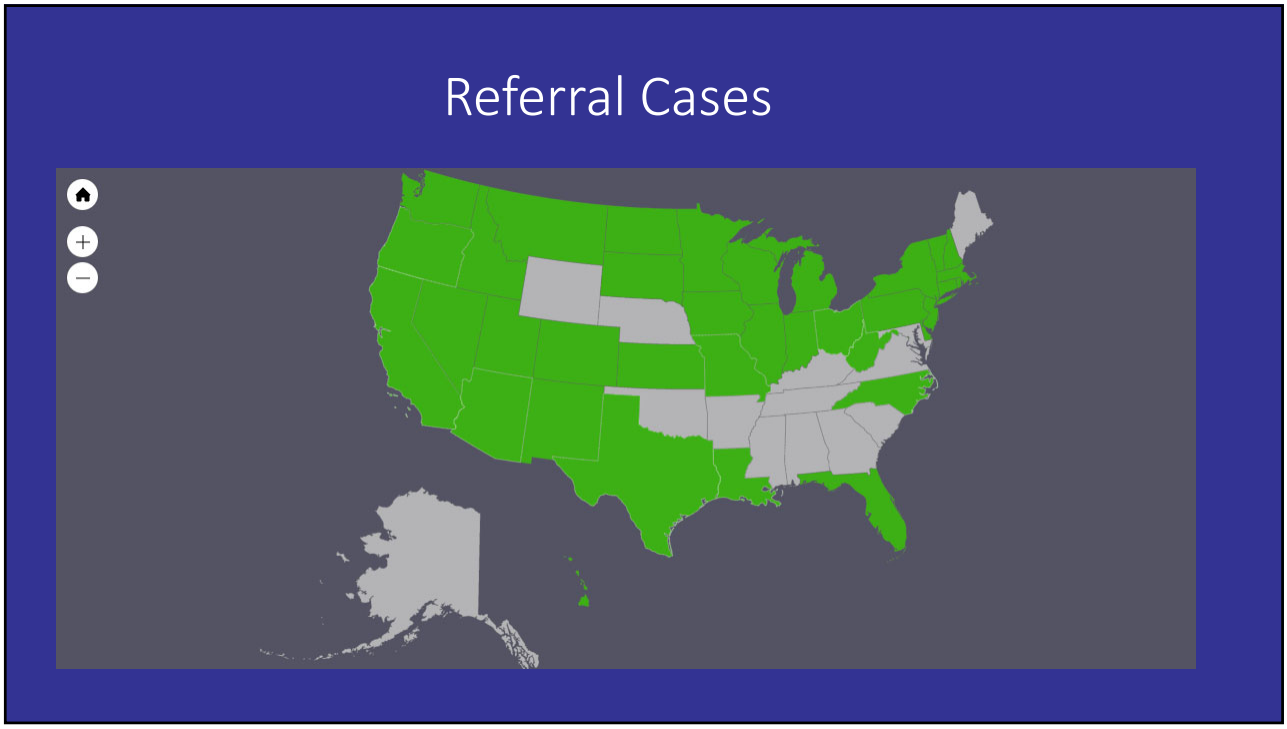

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Cardiac pathology compared to surgical pathology

- Cardiac pathology - surgical and autopsy pathology
  - Surgical pathologists.
  - Forensic pathologists.
- Conditions causing sudden death are very different than surgical specimens
- Important to diagnoses conditions with potential familial component
  - Aortic disease
  - Bicuspid aortic valve
  - Cardiomyopathies

31

Allina Cases

- Currently examine all Allina explanted hearts and autopsy hearts.
- Retained at the Registry indefinitely.

32

Explanted hearts

2 major diagnoses:

- Non-ischemic cardiomyopathy
- Ischemic cardiomyopathy

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Nonischemic cardiomyopathy

- Establish a definitive diagnosis.
- Recommend testing for family members on potentially heritable conditions.
- Resource for the patients and families.

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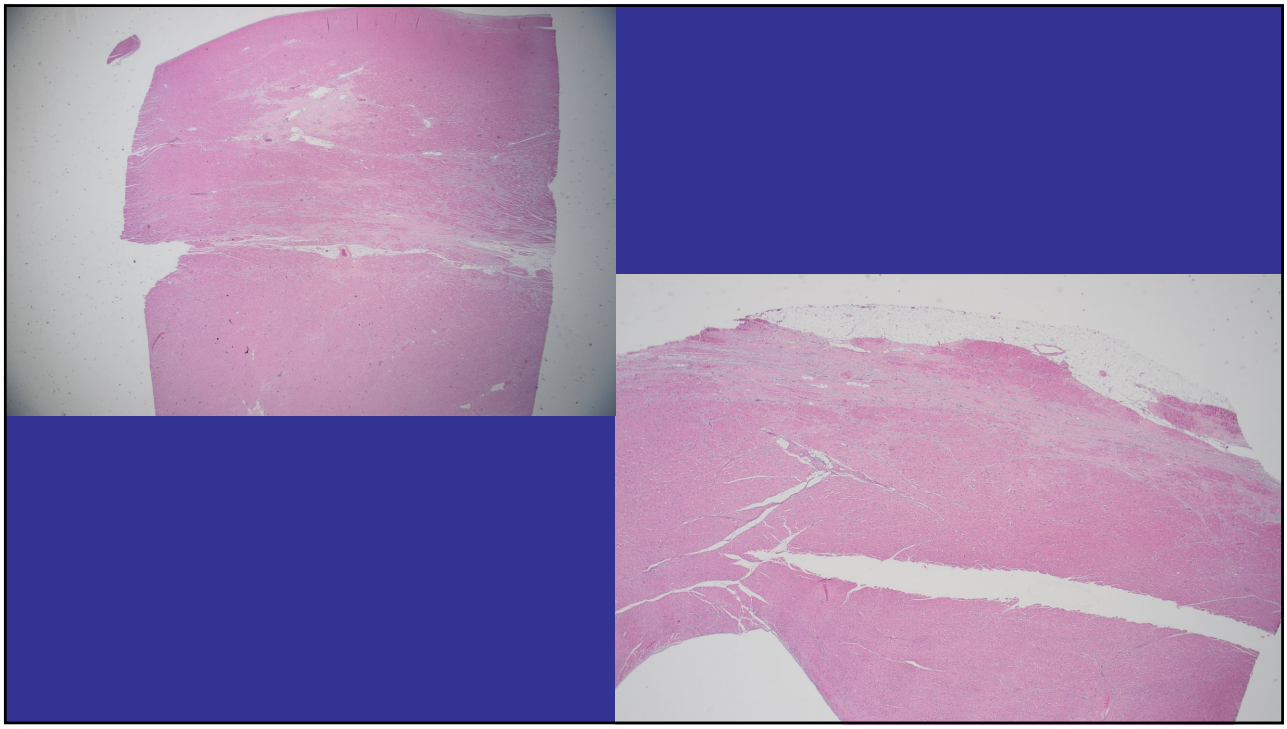

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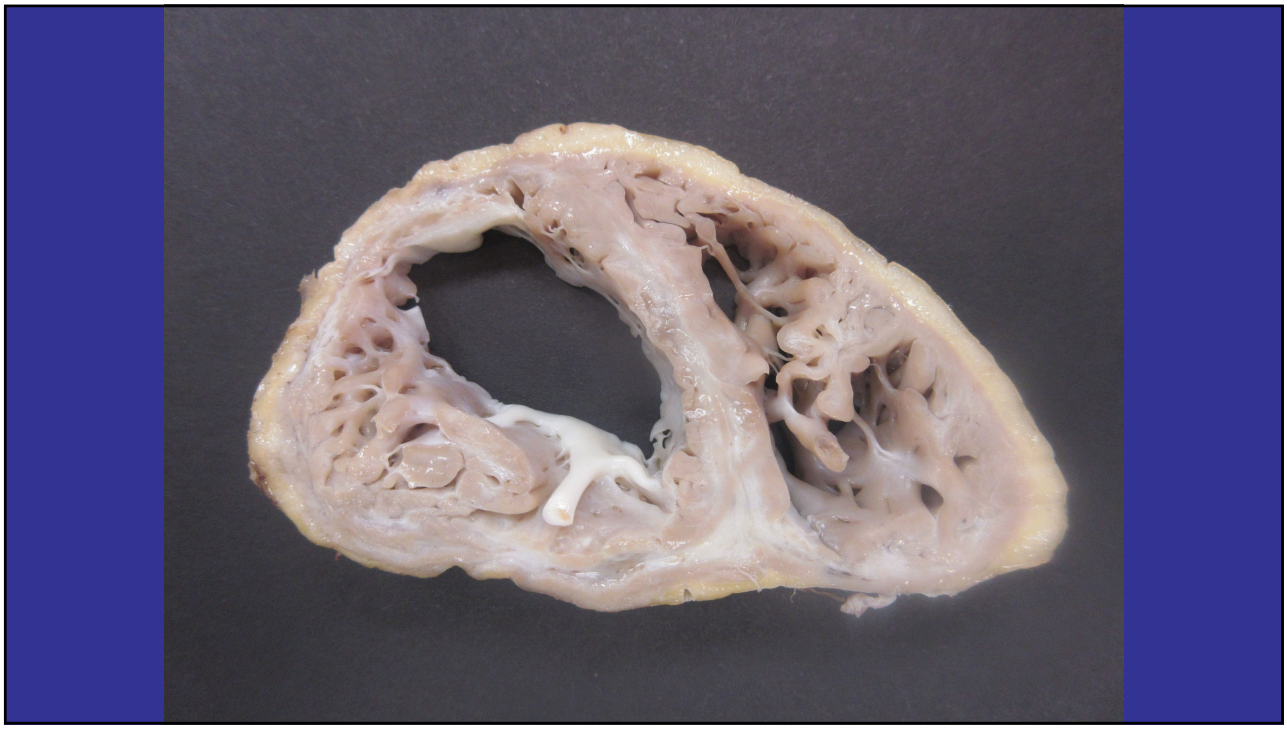

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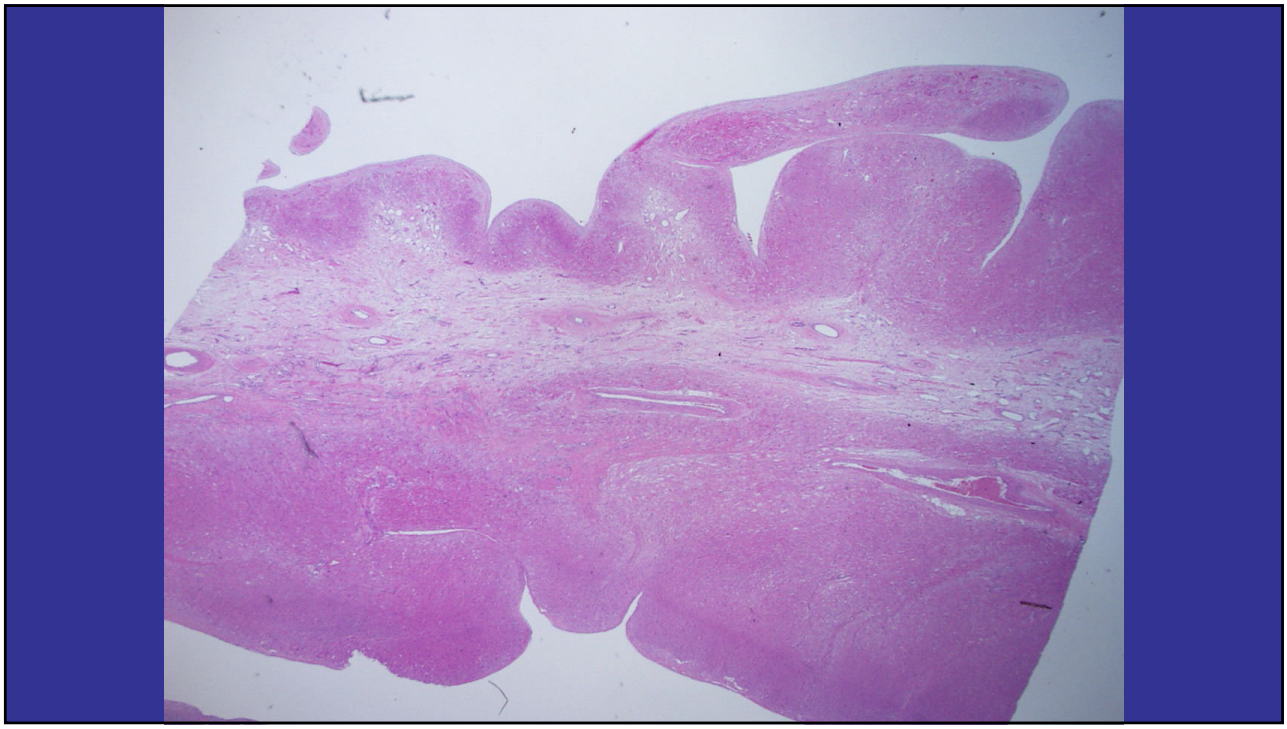

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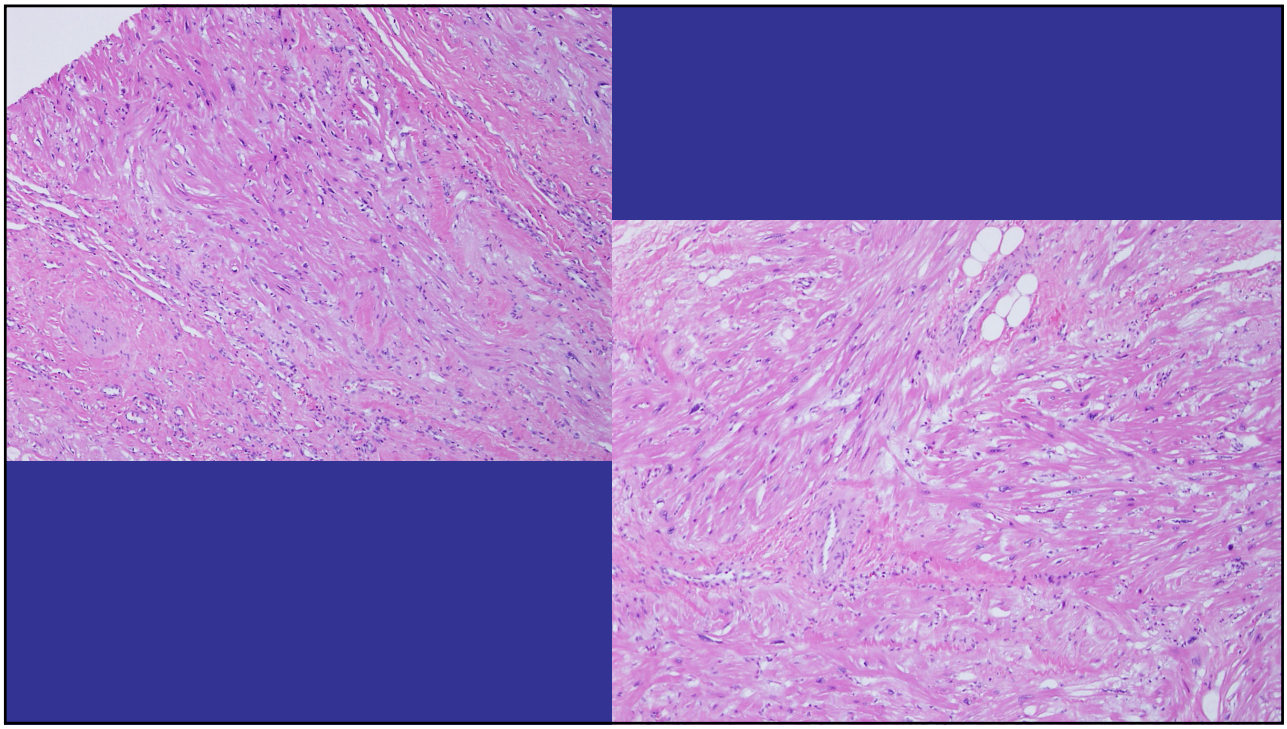

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Devices

Examine devices present with the heart.

- Clots
- Leaks
- Obstruction

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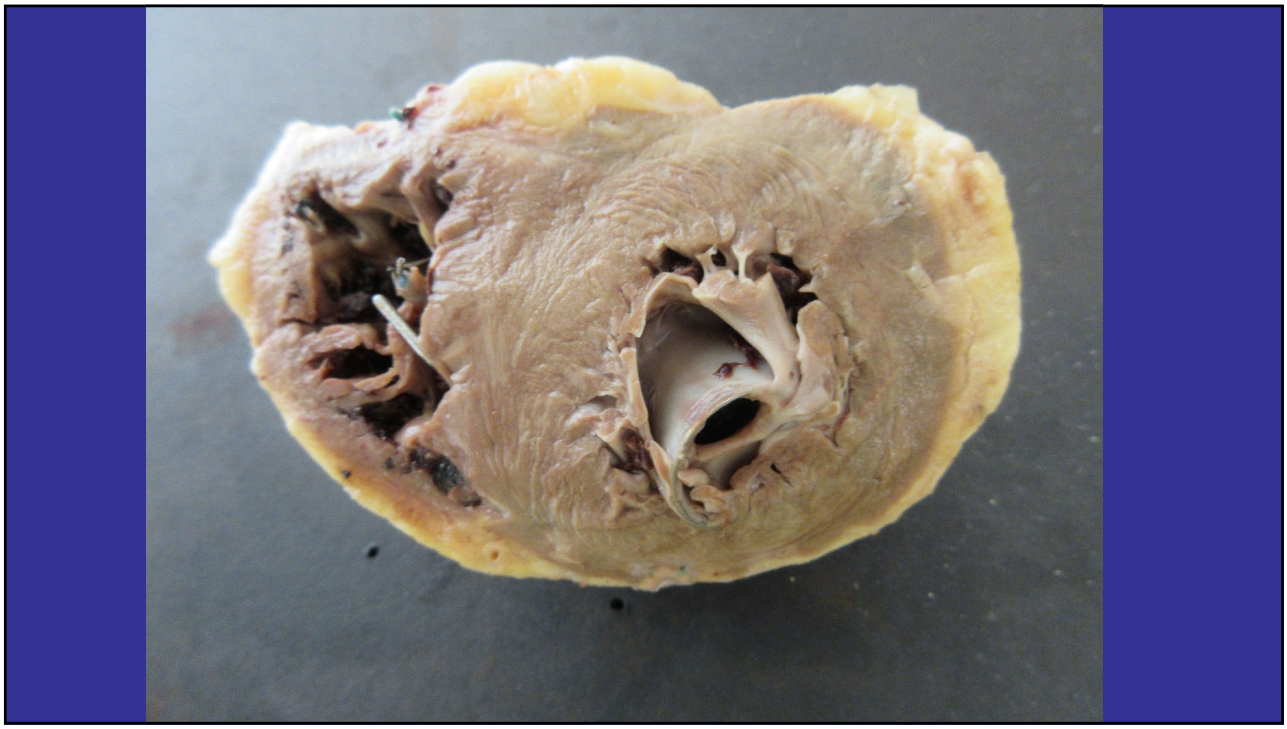

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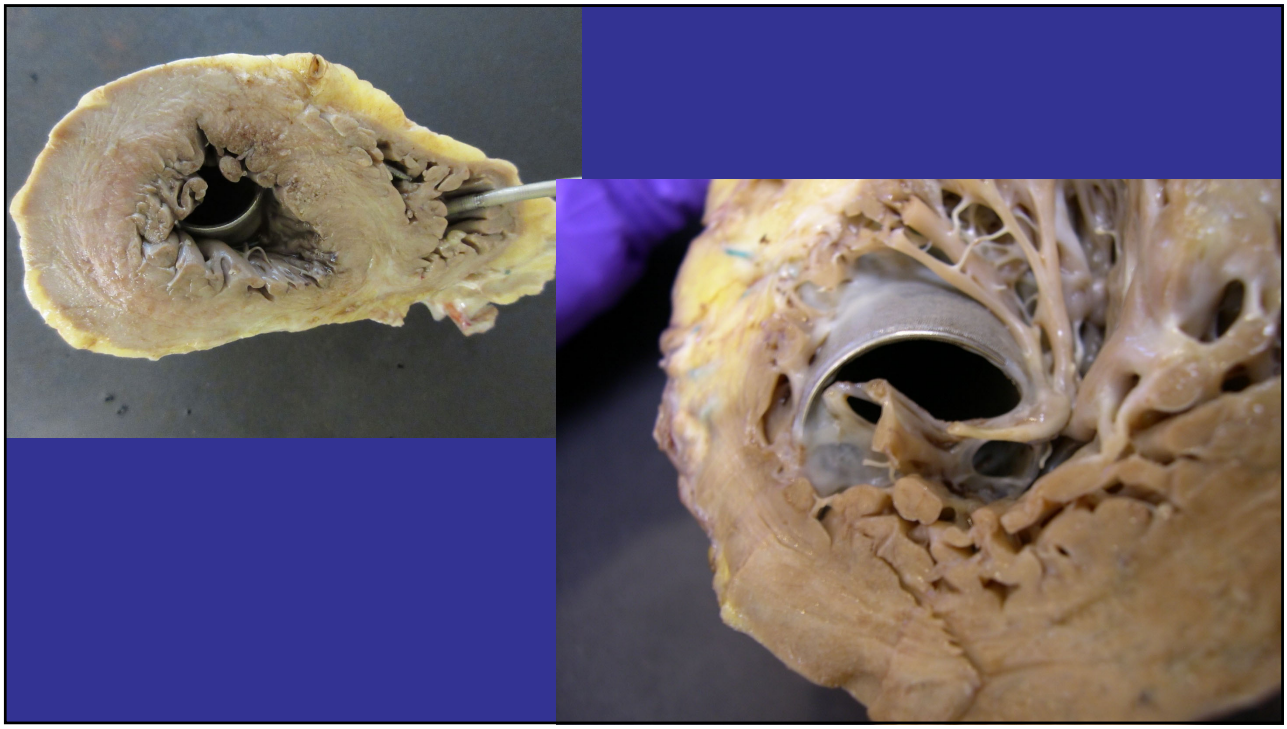


42

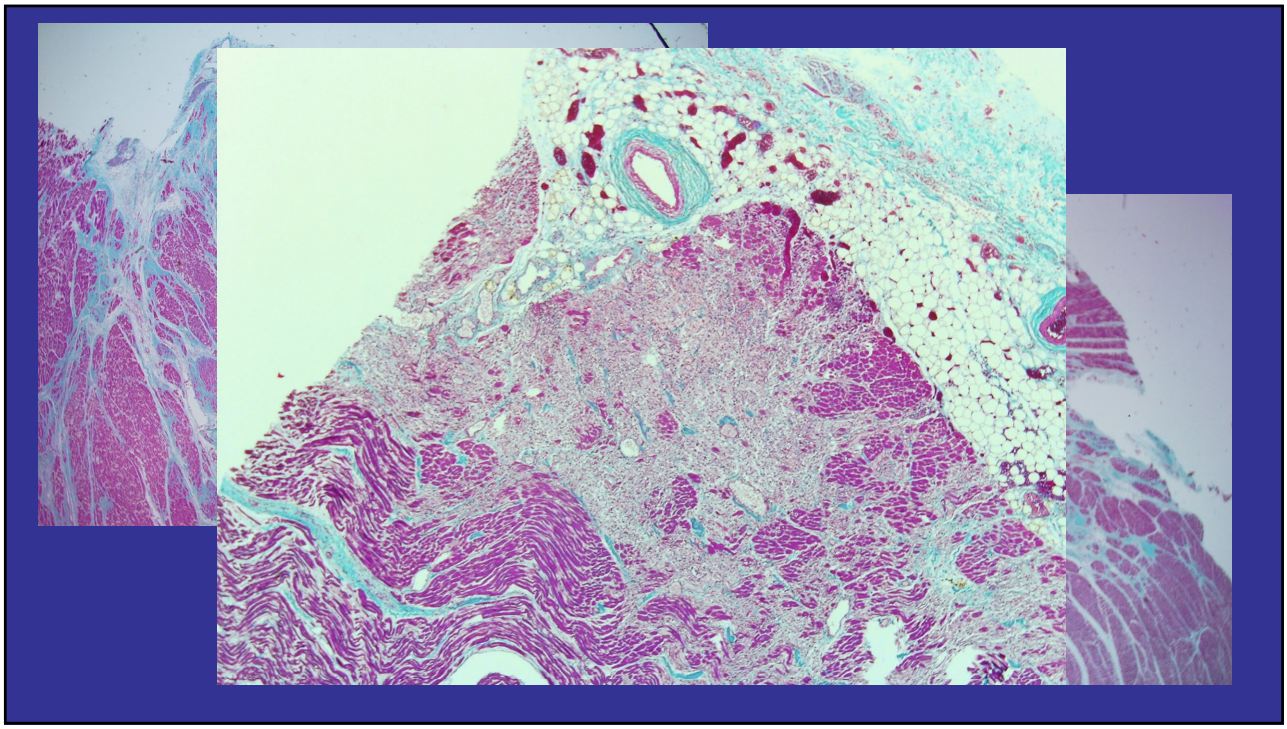
Collaboration

- Patients contact us and want to “visit their heart”.
- May aid in establishing a definitive diagnosis.
- LVAD devices
  - We can’t dismantle Heartmate 3; need assistance if device needs evaluation.
  - Do you want us to keep the devices? If so, all of them? Which ones?
- Any interest in setting up a conference with us to discuss the pathology?

43

Arrhythmogenic cardiomyopathy

44



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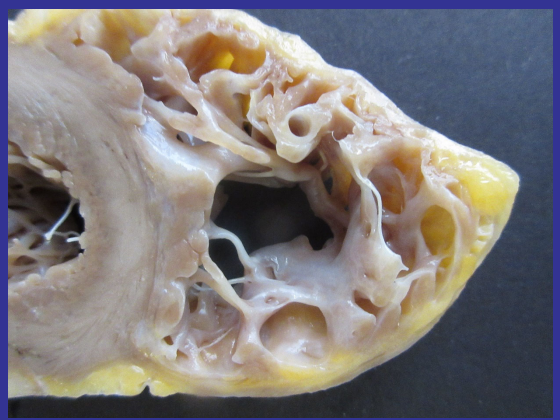
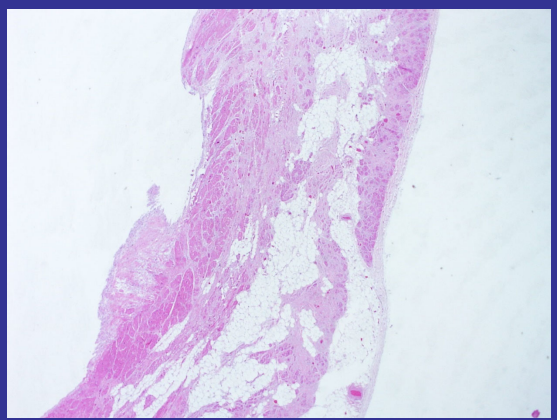
ARVC





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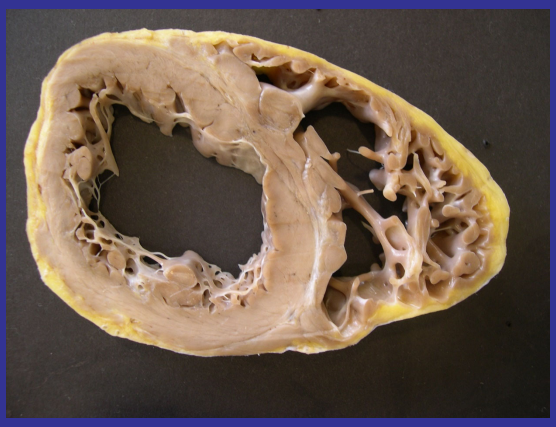
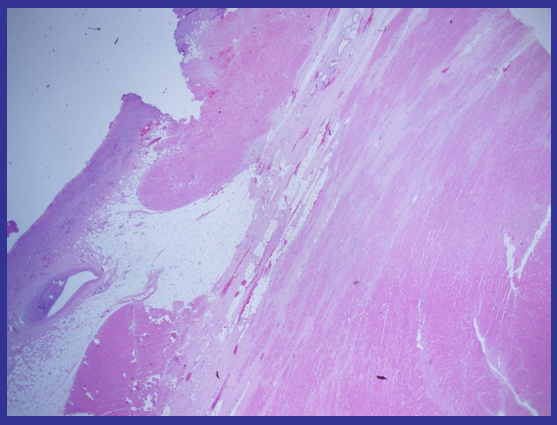
Arrhythmogenic cardiomyopathy – ACM or ALVC





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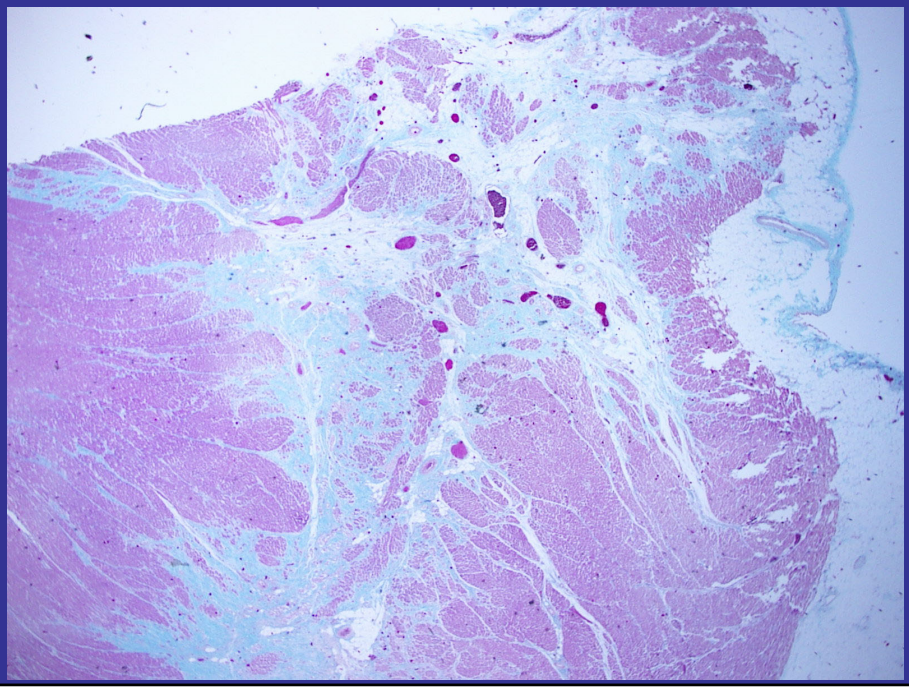

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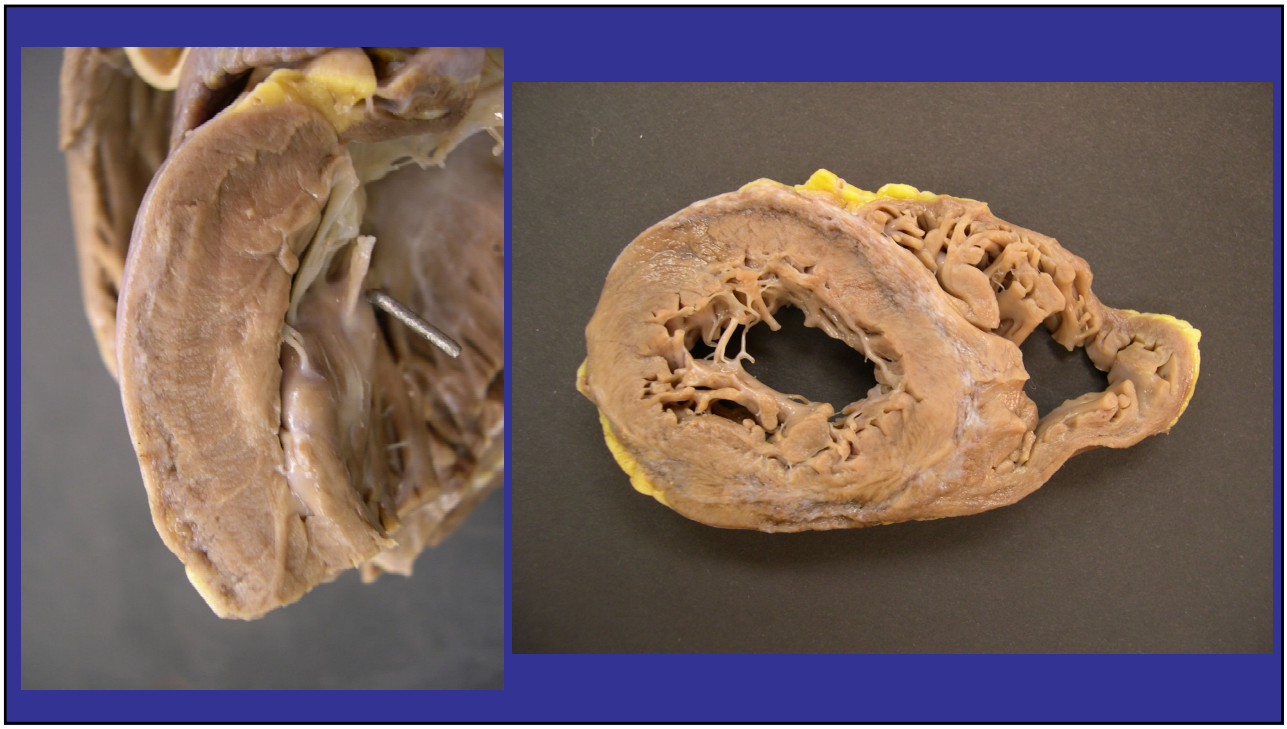

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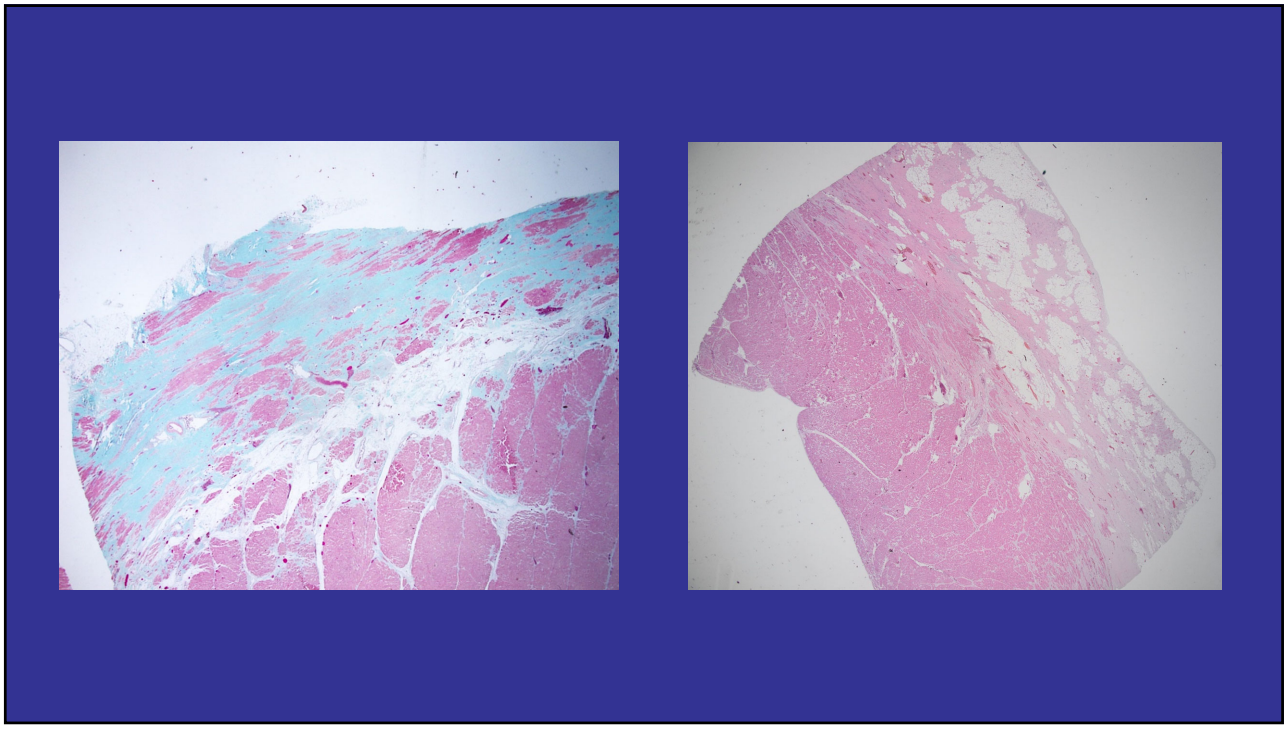

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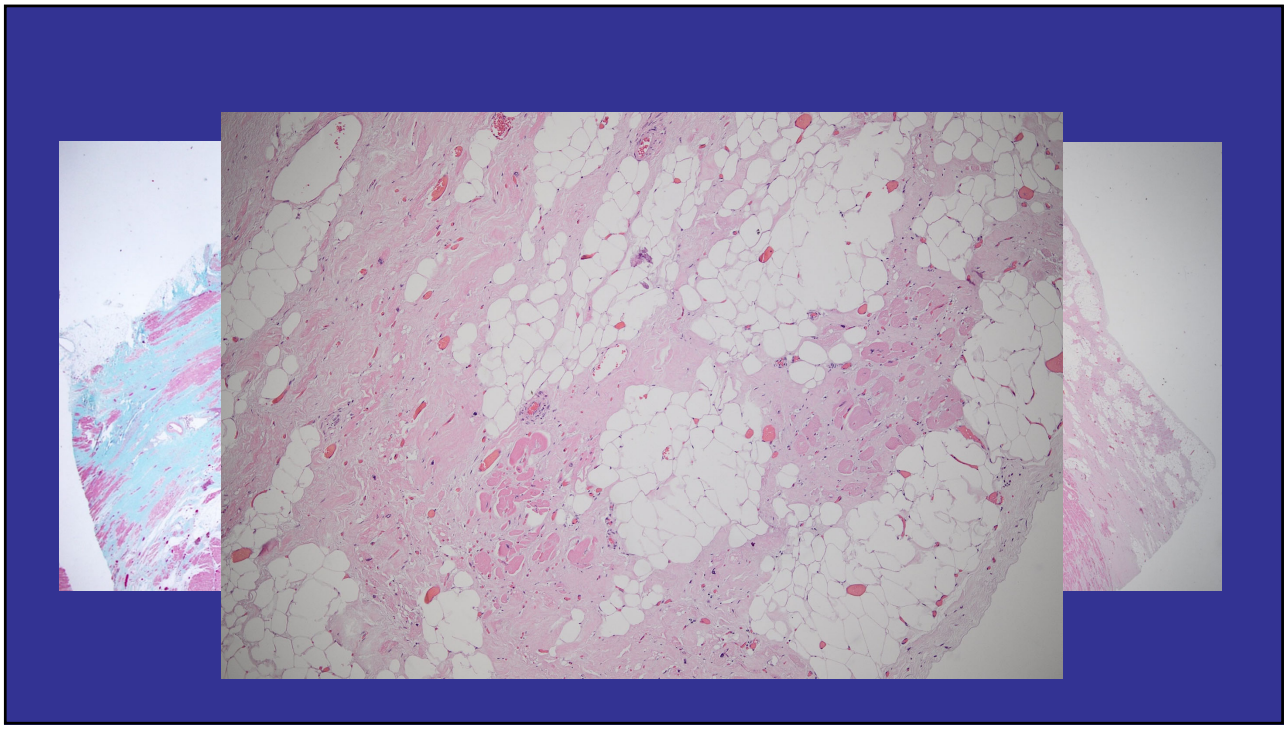

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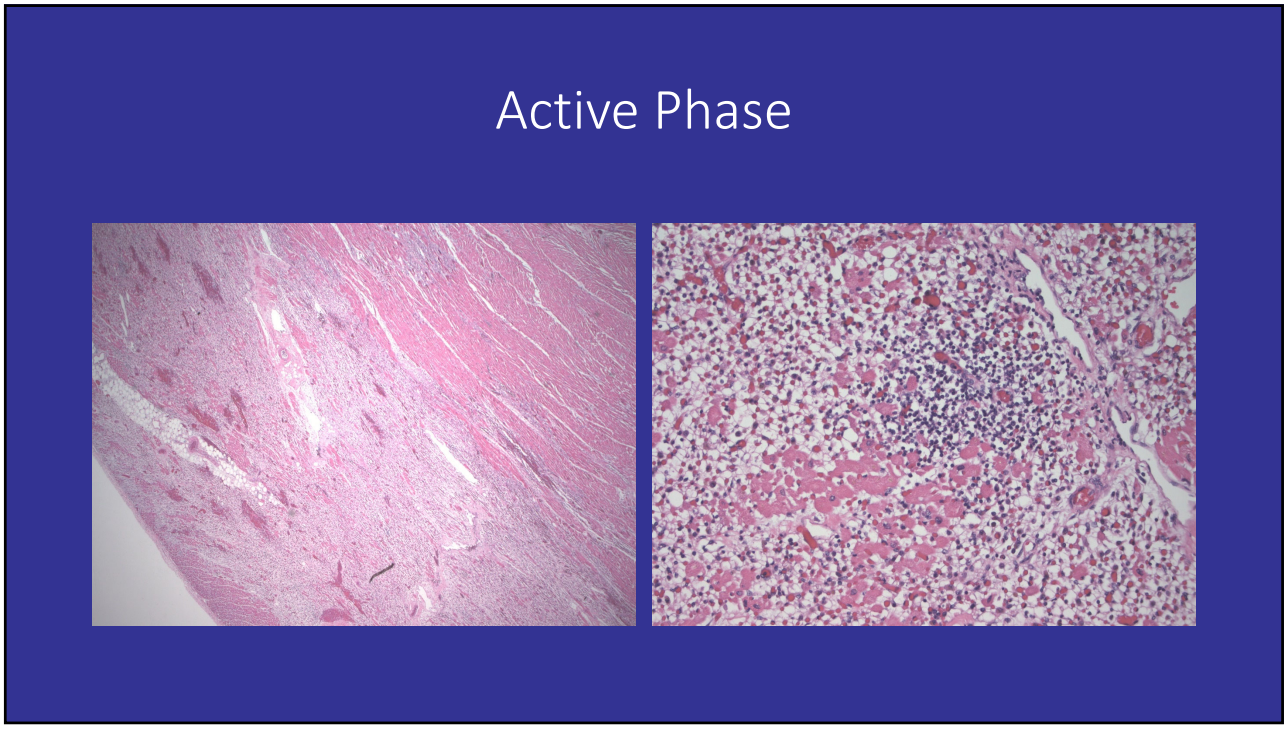

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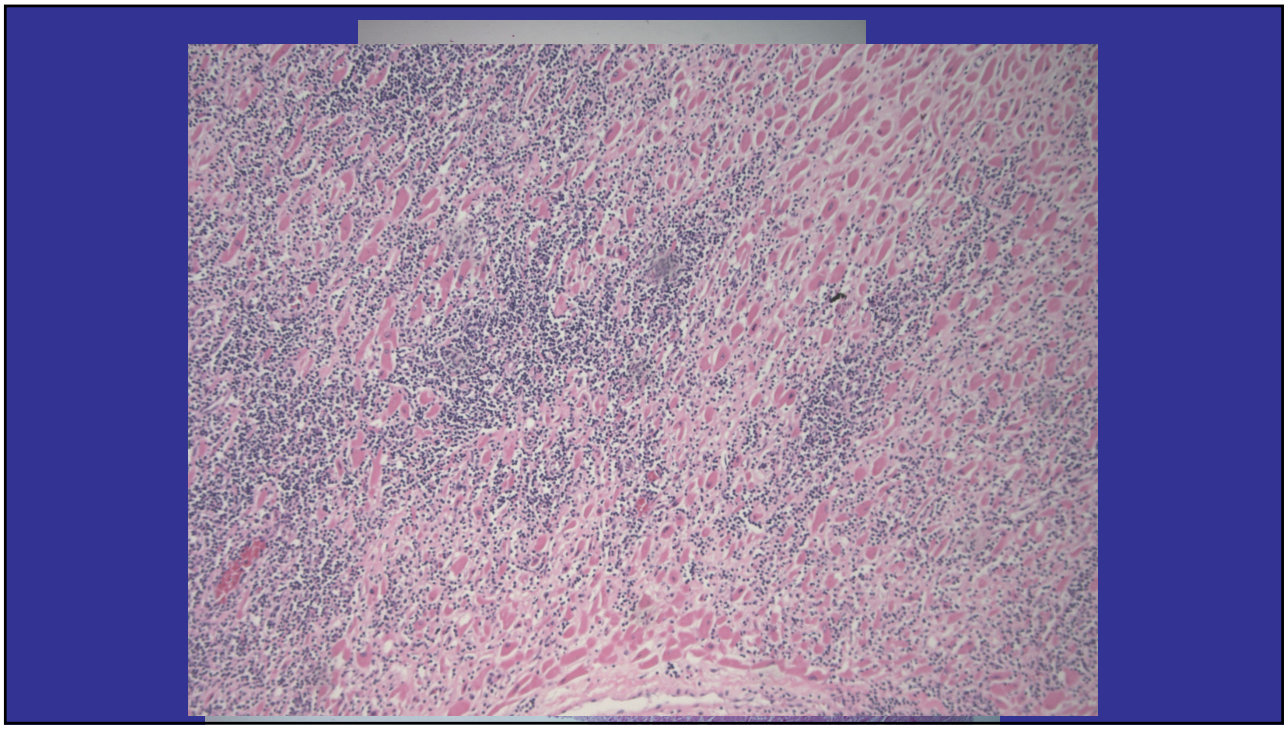

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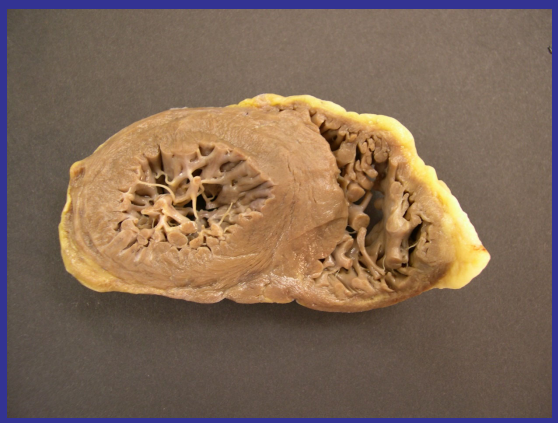
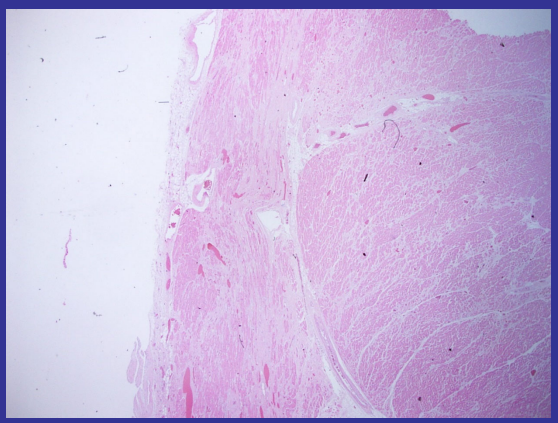
Minimal or no gross findings





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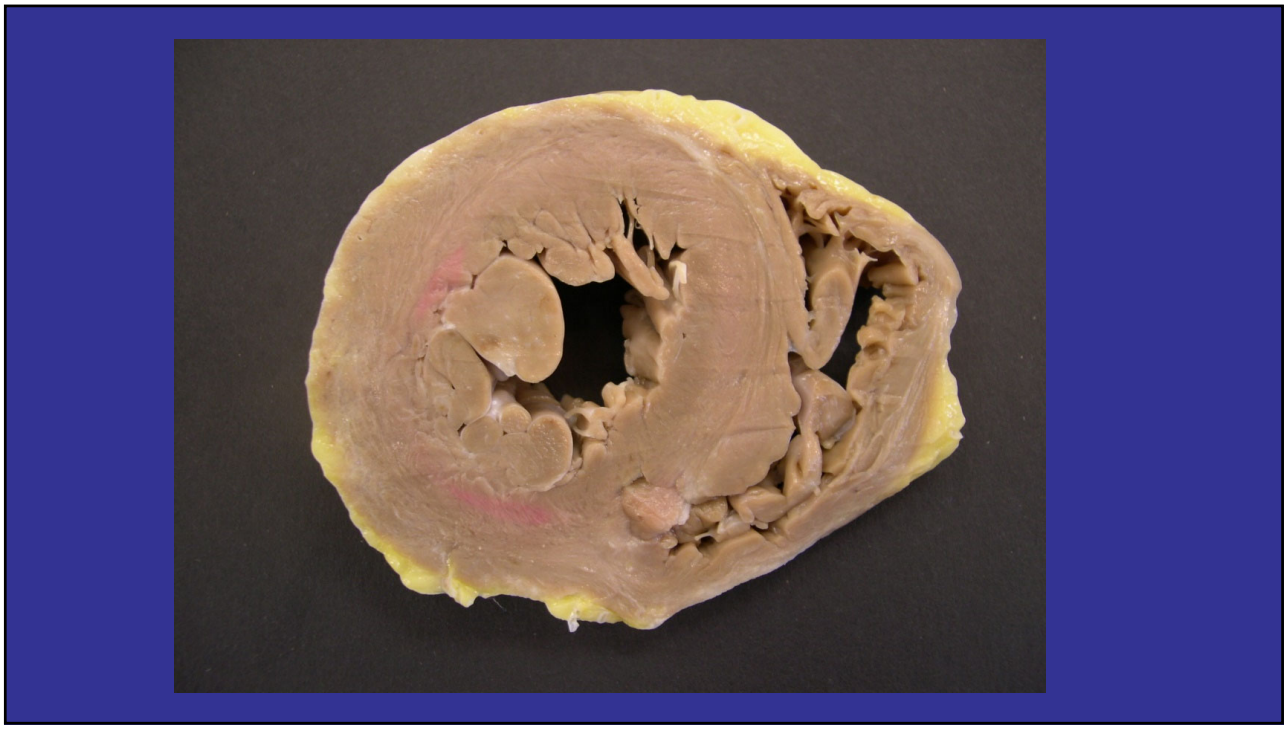

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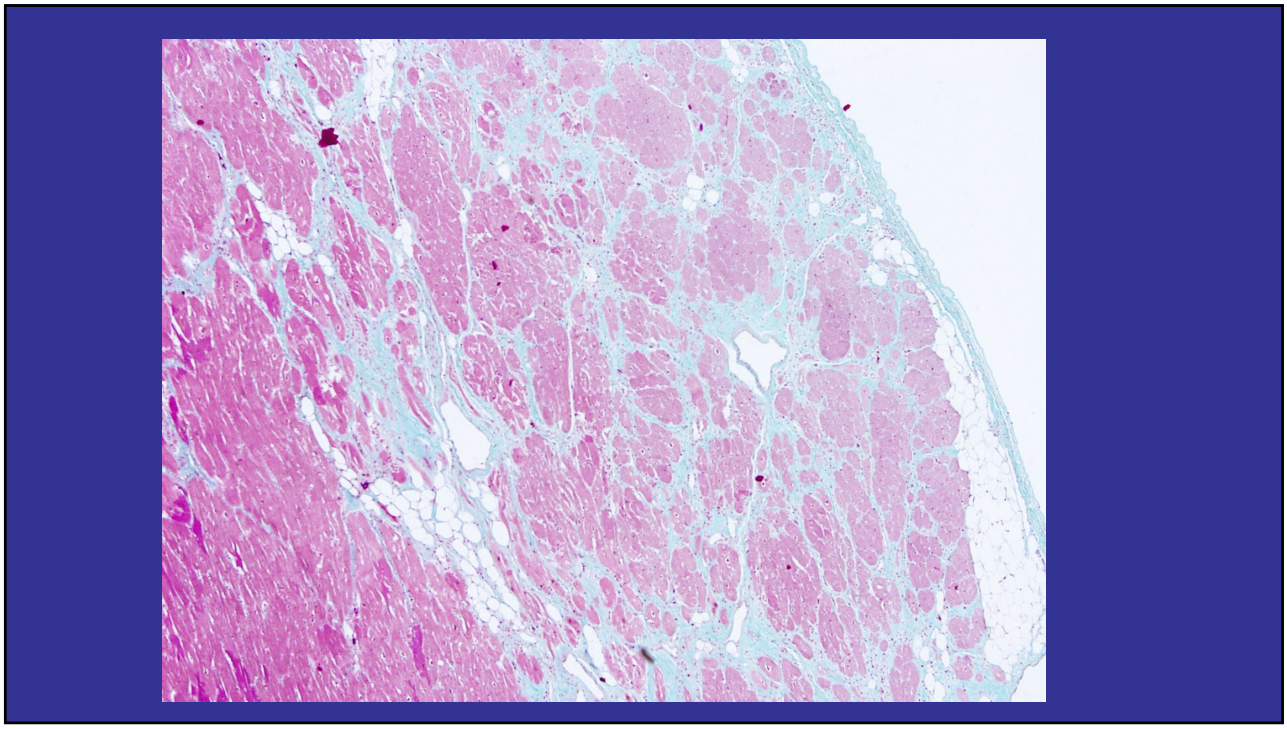

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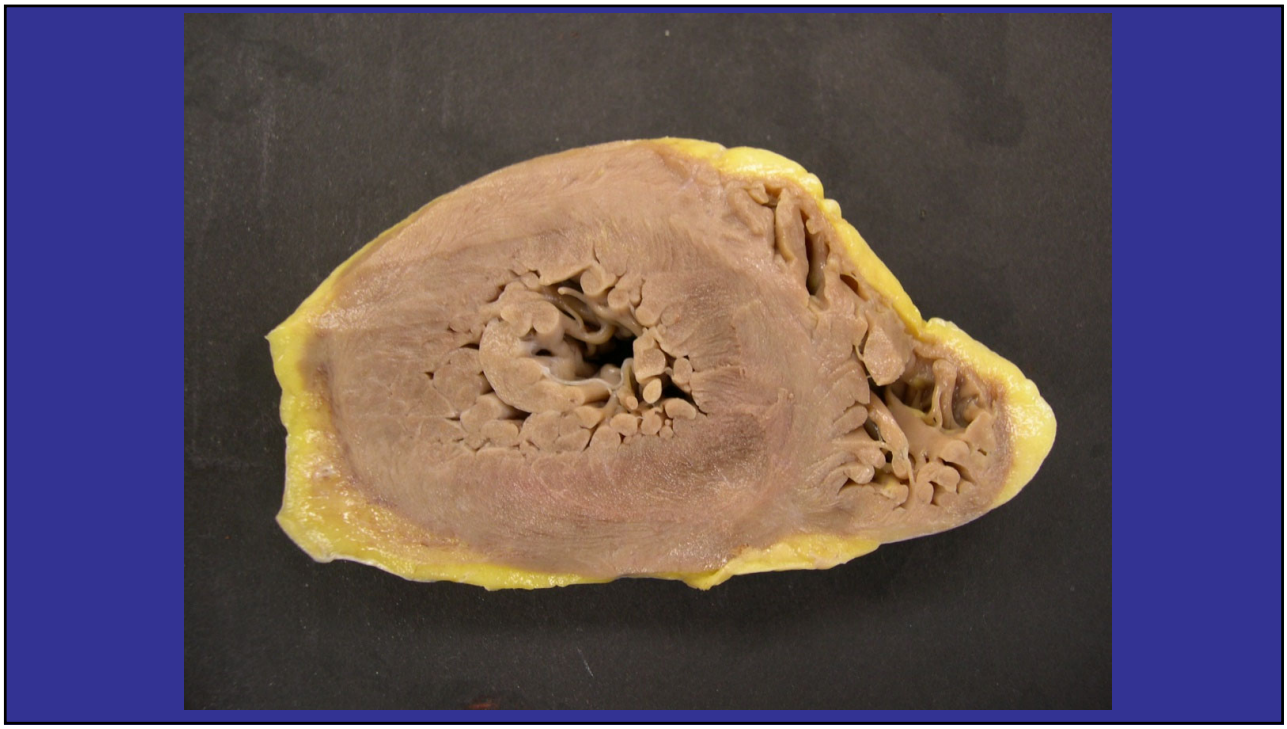

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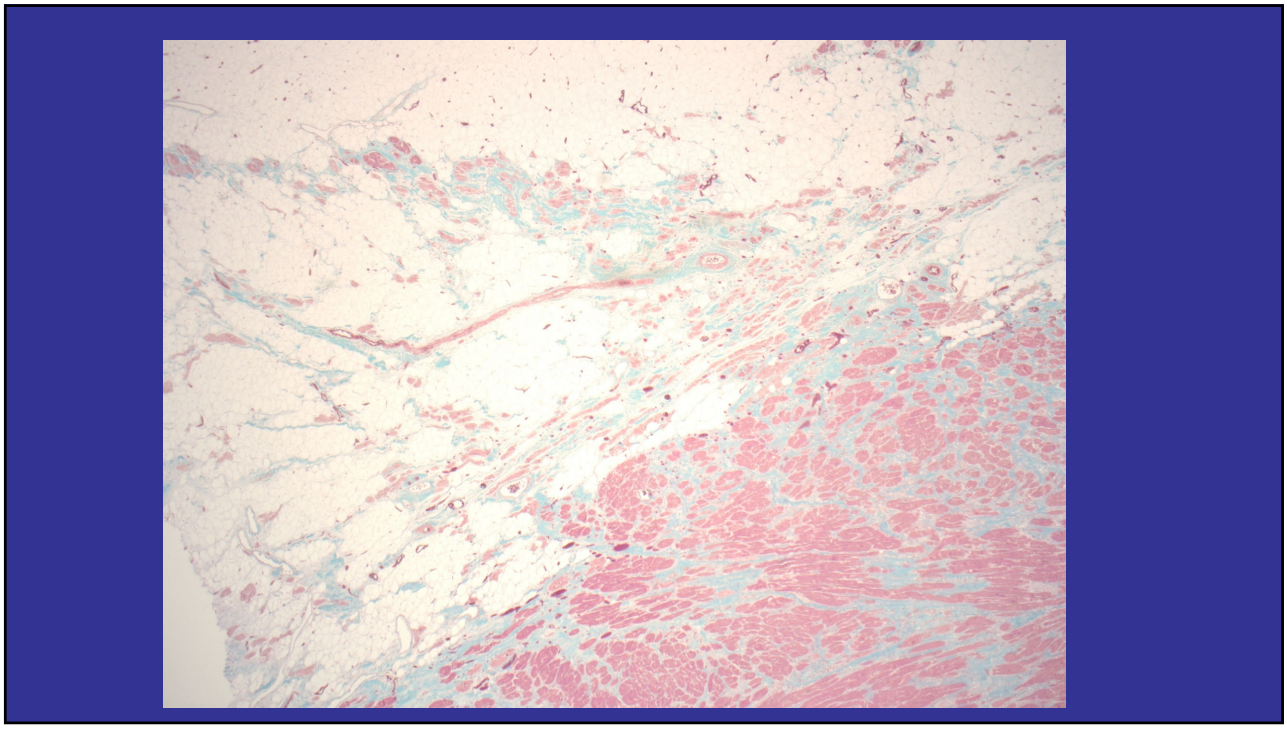


58

COVID-19 and the Heart

59

COVID

- 23 cases
  - 15 died in hospital; 8 out of hospital
- 15 Male: 8 female
- 7 were >65
- 2 were <10
- 1 was pregnant

60

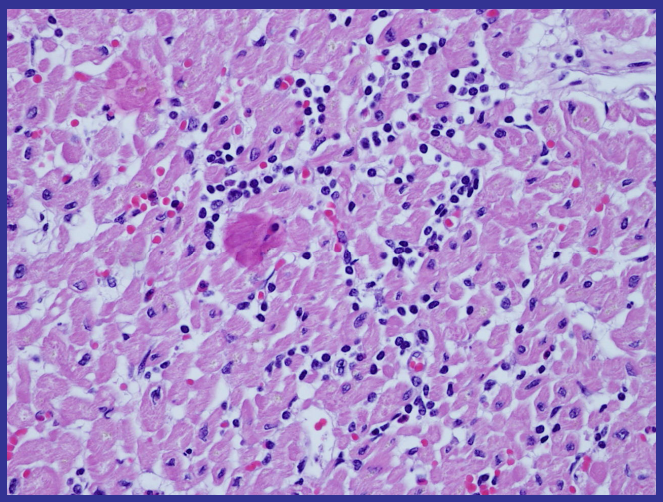
Cardiac findings

- 16 with COVID had additional cardiac disease:
  - 1 Acute MI with rupture
  - 1 HCM
  - 1 ALVC
  - 8 Severe atherosclerotic coronary artery disease
  - 4 Cardiomegaly
  - 1 Congenital pulmonary valve stenosis

61

COVID- associated myocarditis

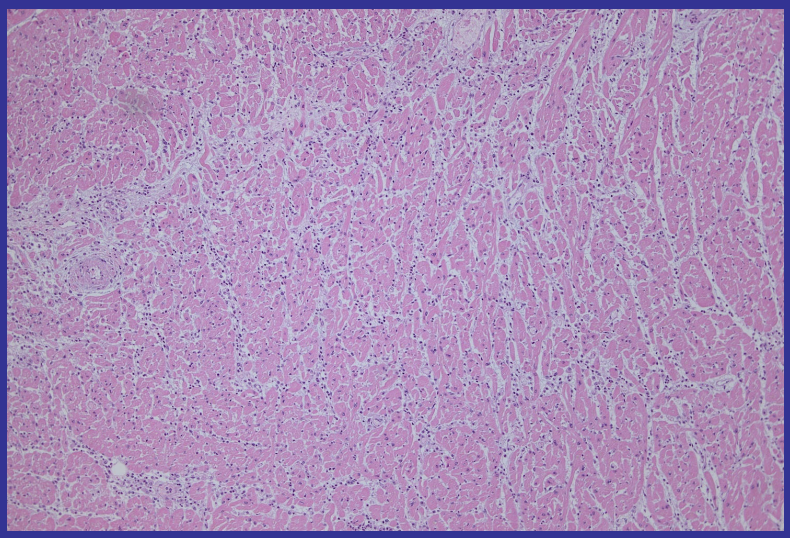
- 3 with myocarditis
  - Inflammation was predominantly lymphocytic with occasional eosinophils.
- Also had diffuse hypereosinophilic myocytes, which is seen with global myocardial hypoperfusion, stress cardiomyopathy and catecholamine response.
  - Non specific, but indicates cardiac strain/ stress



62

COVID associated myocardial damage

- Prominent interstitial inflammation, mainly perivascular and interstitial
  - Predominantly neutrophilic
  - Some histiocytes, eosinophils, lymphocytes
- Extensive myocardial ischemia with hypereosinophilic myocytes
  - Prominent interstitial edema



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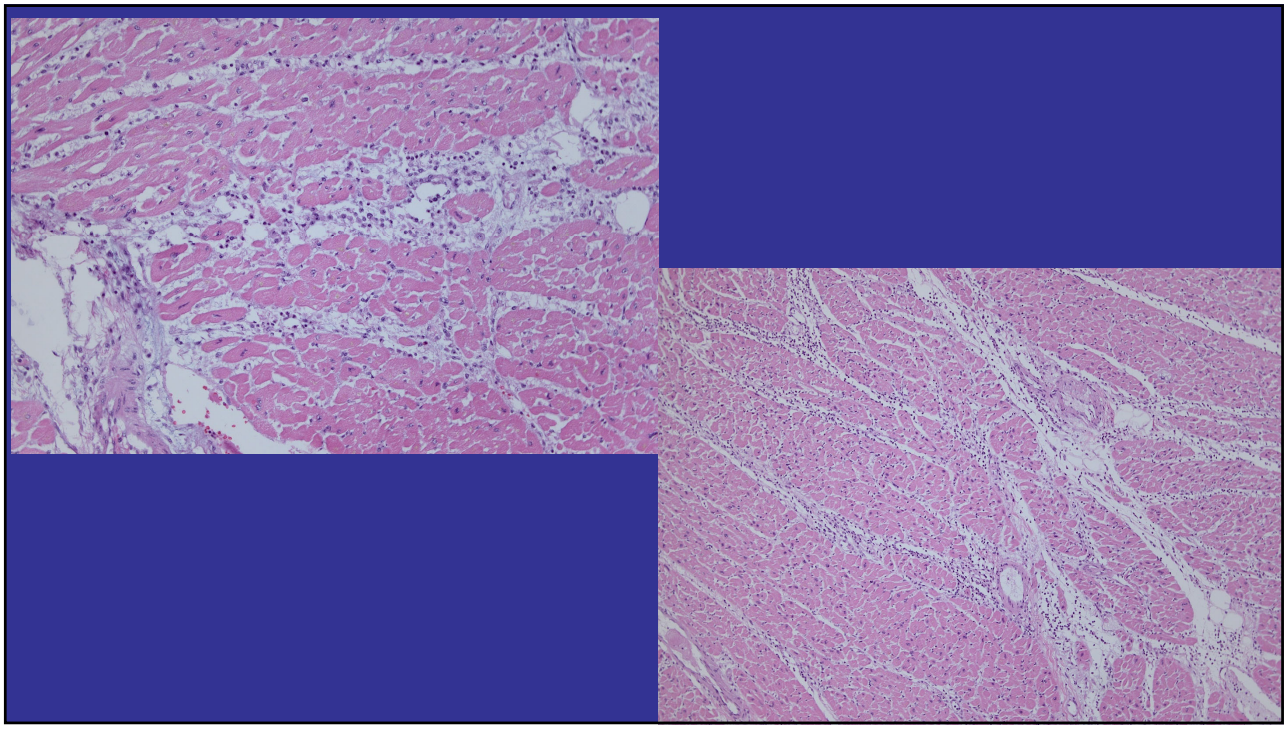

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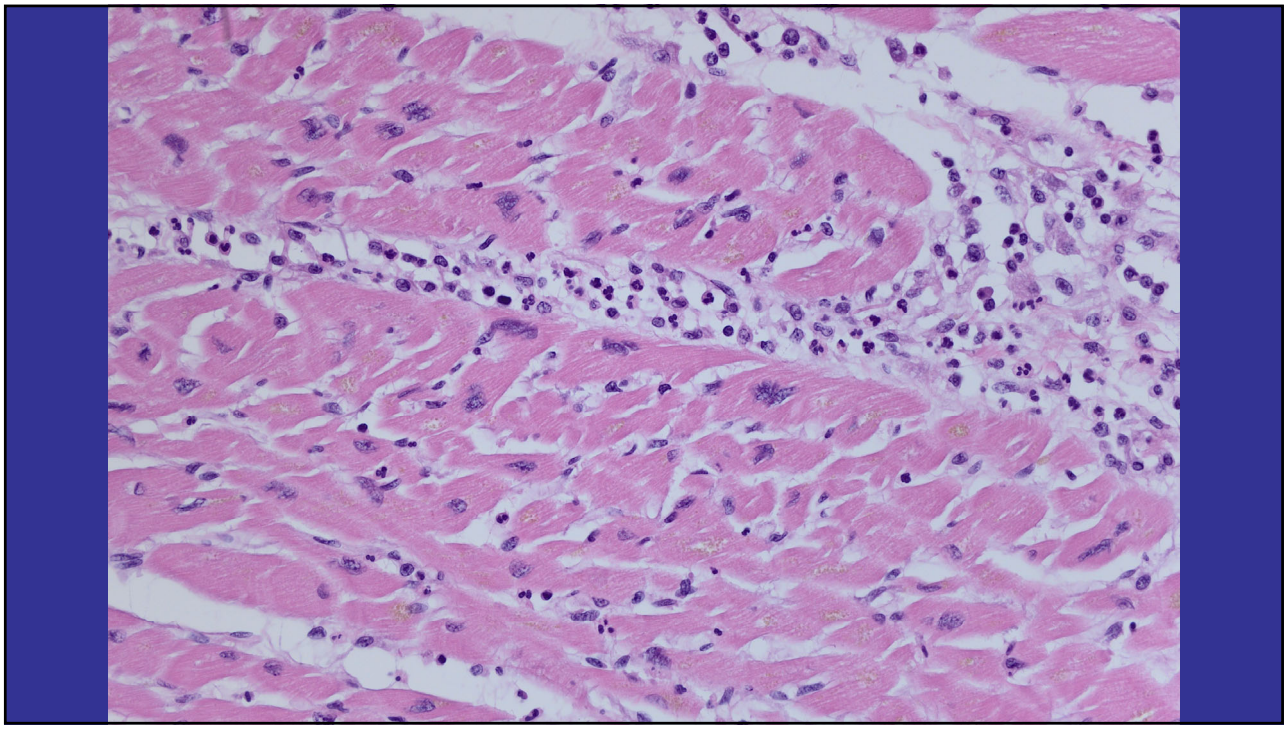

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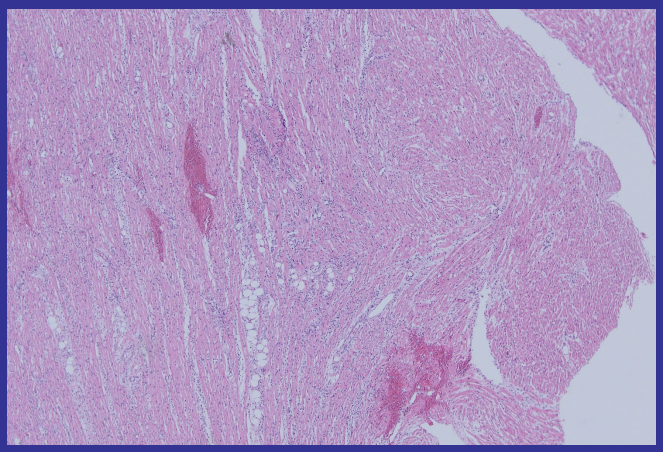
Right ventricular strain

- Essentially the same changes, but in RV
  - Hypereosinophilic myocytes and areas of ischemia
  - Marked interstitial and perivascular inflammation
  - Interstitial edema
- Caused by acute pulmonary conditions
  - Also see with PE



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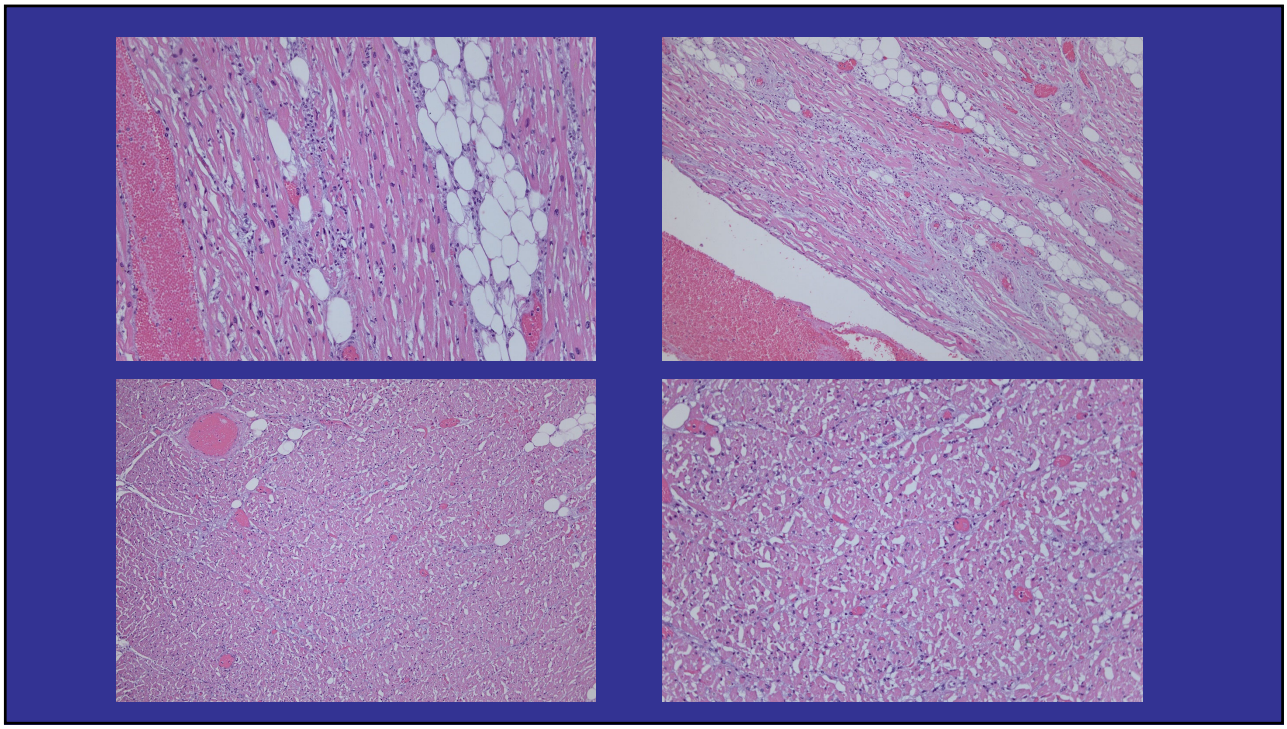

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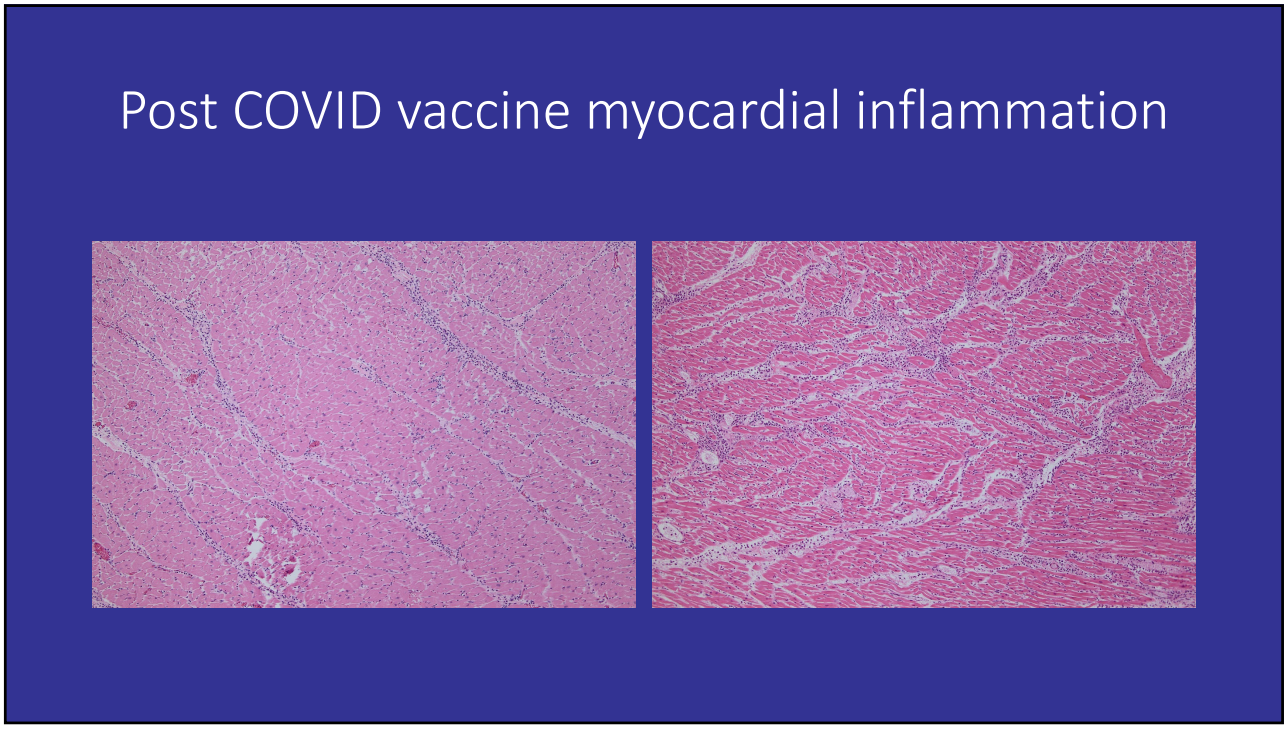

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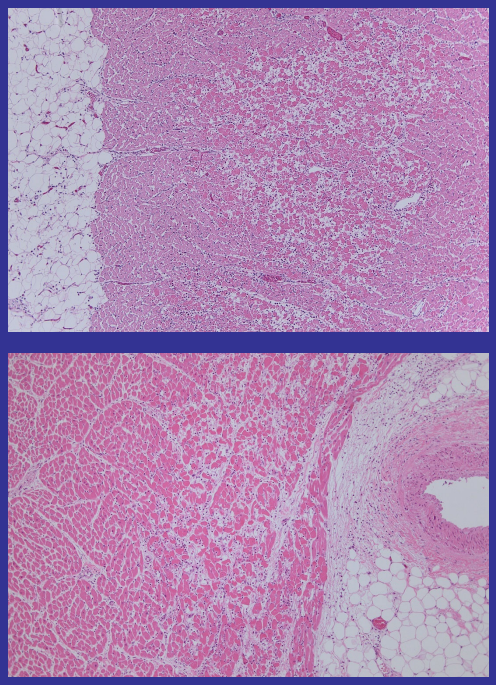

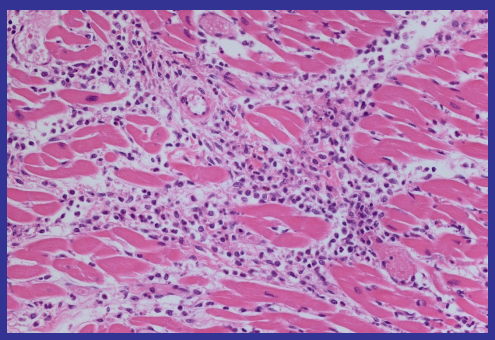

69

COVID ASSOCIATED MYOCARDIAL INJURY

- Similar histologic picture seen in some cases of COVID and post COVID vaccine
  - Much more common with COVID, rare following vaccination
- Immune mediated response.
- What will happen long term?

70

Contact Information

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71