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# Jesse E Edwards Registry of Cardiovascular Disease

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## 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

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## 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.

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- Pediatric Cardiology didn't exist as a specialty.
- 1947 given 105 autopsy specimens of congenital heart disease collected since the Clinic began.

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## 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

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## 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.”

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## The afternoon teaching sessions



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

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## Legacy

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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.

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## 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.

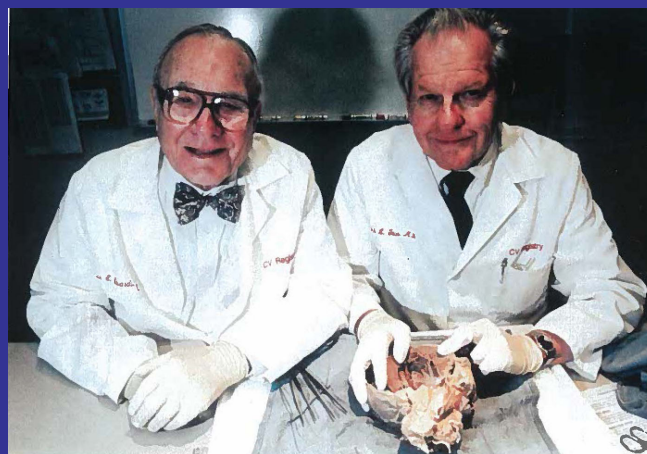
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## Evolution of the Registry

Cardiac Pathology Consult Lab

Jesse Edwards 1960-1987

Jack Titus 1987-2004



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## 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.

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## 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

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## 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

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## 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

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## Uses of the Collection

- Teaching
- Research
- Medical innovation

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## Uses of the Collection

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

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## Uses of the Collection

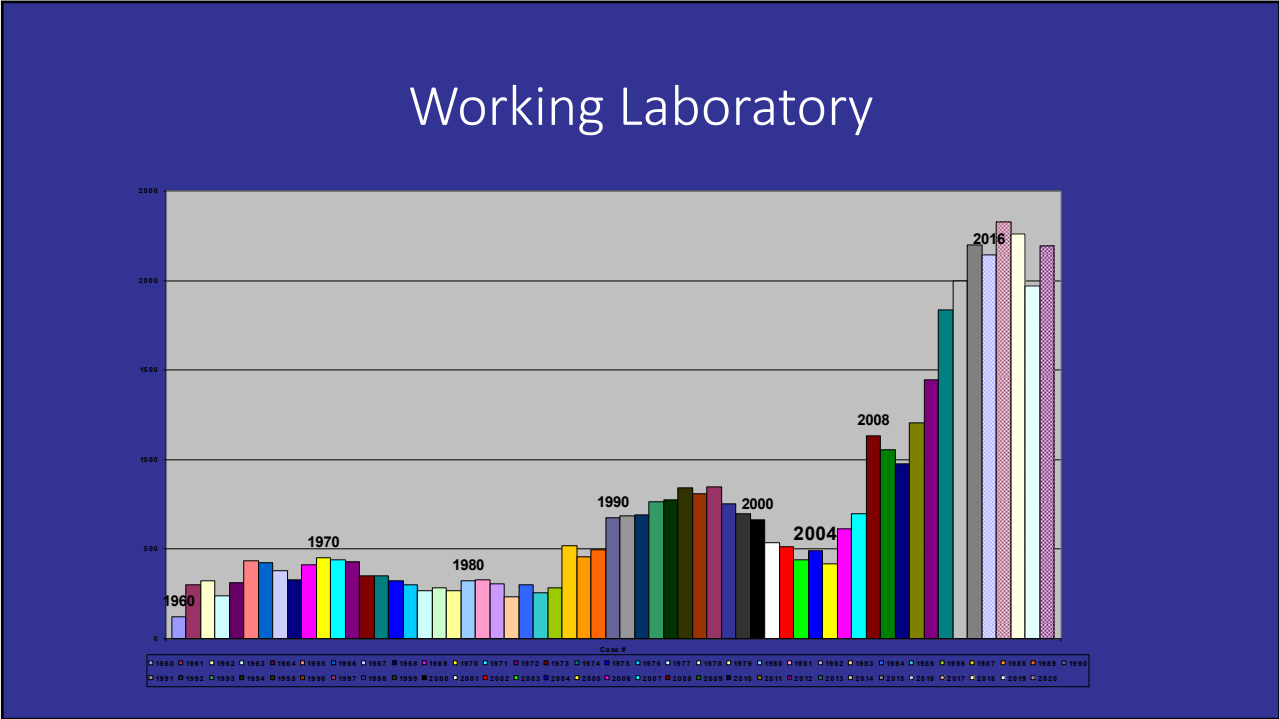
- Teaching
- Research
  - Being at Allina allows us to collaborate on any project with any institution or multiple institutions at once.
- Medical innovation

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## 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

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- ### Types of cases
- Donor Hearts
  - Routine cases
  - Surgical specimens
  - Explanted prosthetic valves

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## 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.

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## Routine Cases

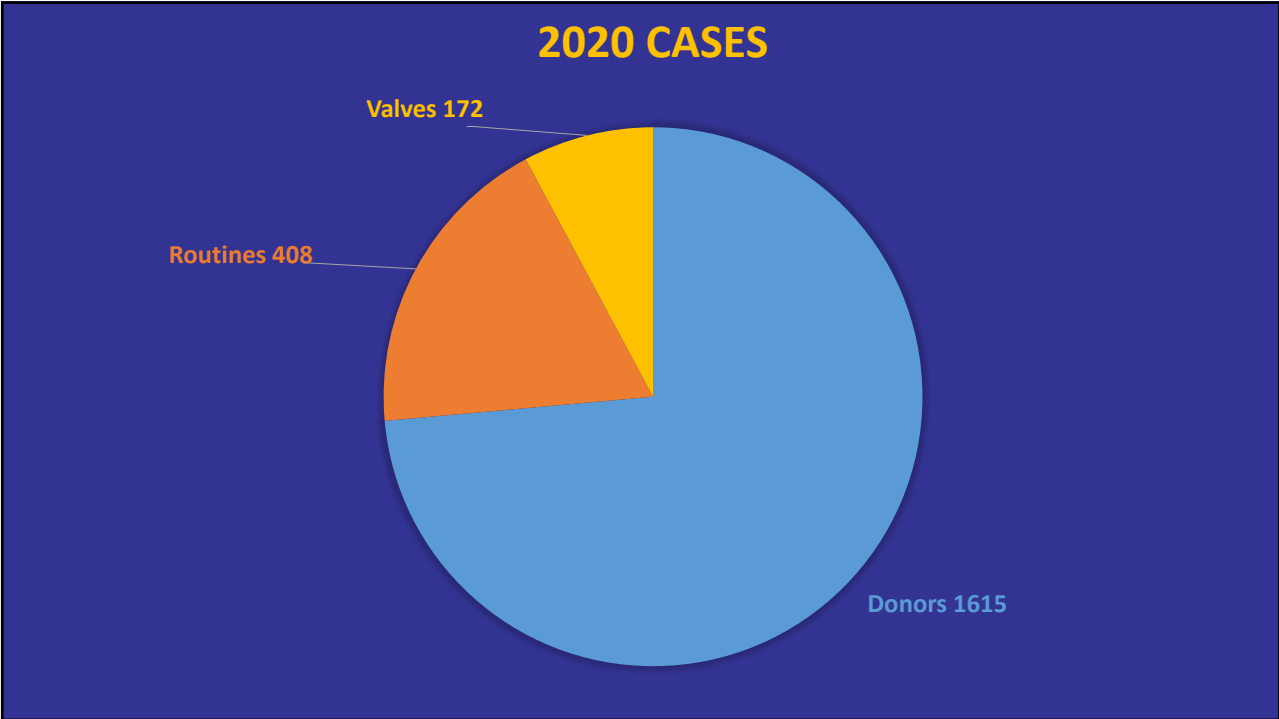
- Surgical specimens:
  - Excised valves or other tissues.
  - Endomyocardial biopsies.
  - Explanted hearts for transplantation.
- Referral hearts:
  - Congenital heart disease.
  - Medical examiner cases for evaluation of sudden death, conduction system studies, evaluation of complex conditions including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

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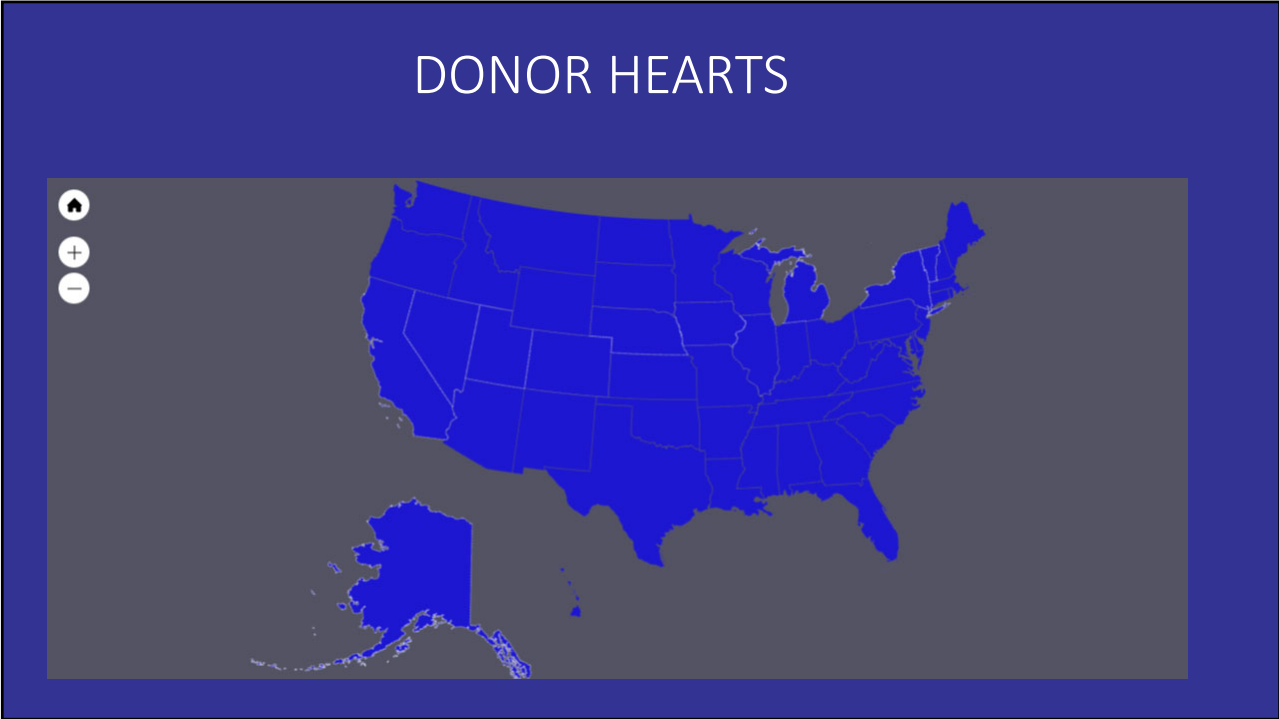
## Excised prosthetic valves

- Examination for compliance with FDA requirements for medical devices.

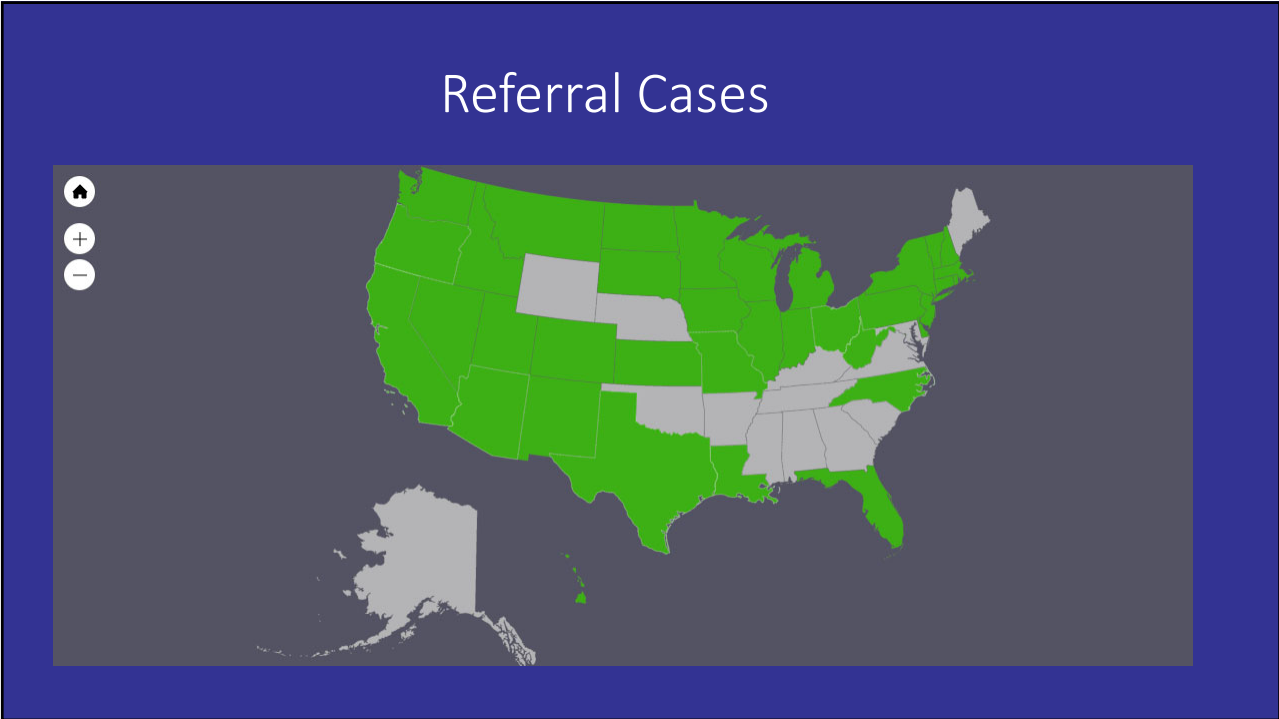
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## Cardiac pathology compared to surgical pathology

- 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

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## Allina Cases

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

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## Explanted hearts

2 major diagnoses:

- Non-ischemic cardiomyopathy
- Ischemic cardiomyopathy

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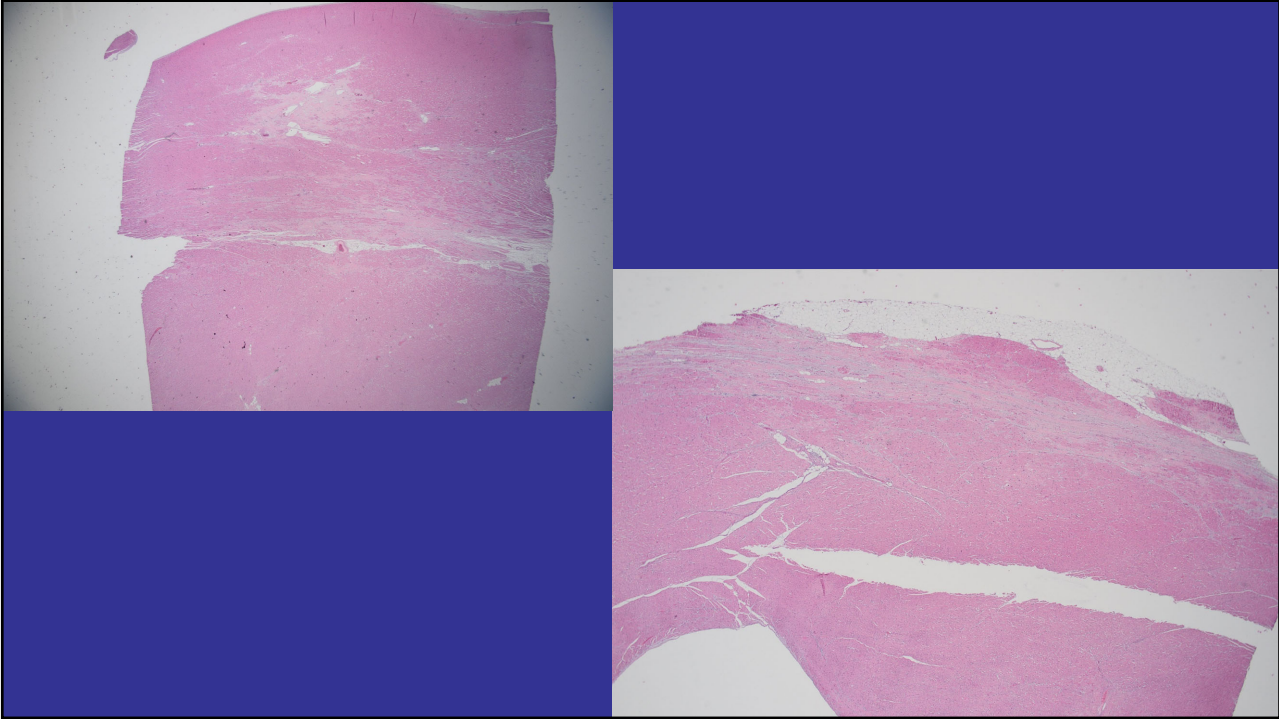
## Nonischemic cardiomyopathy

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

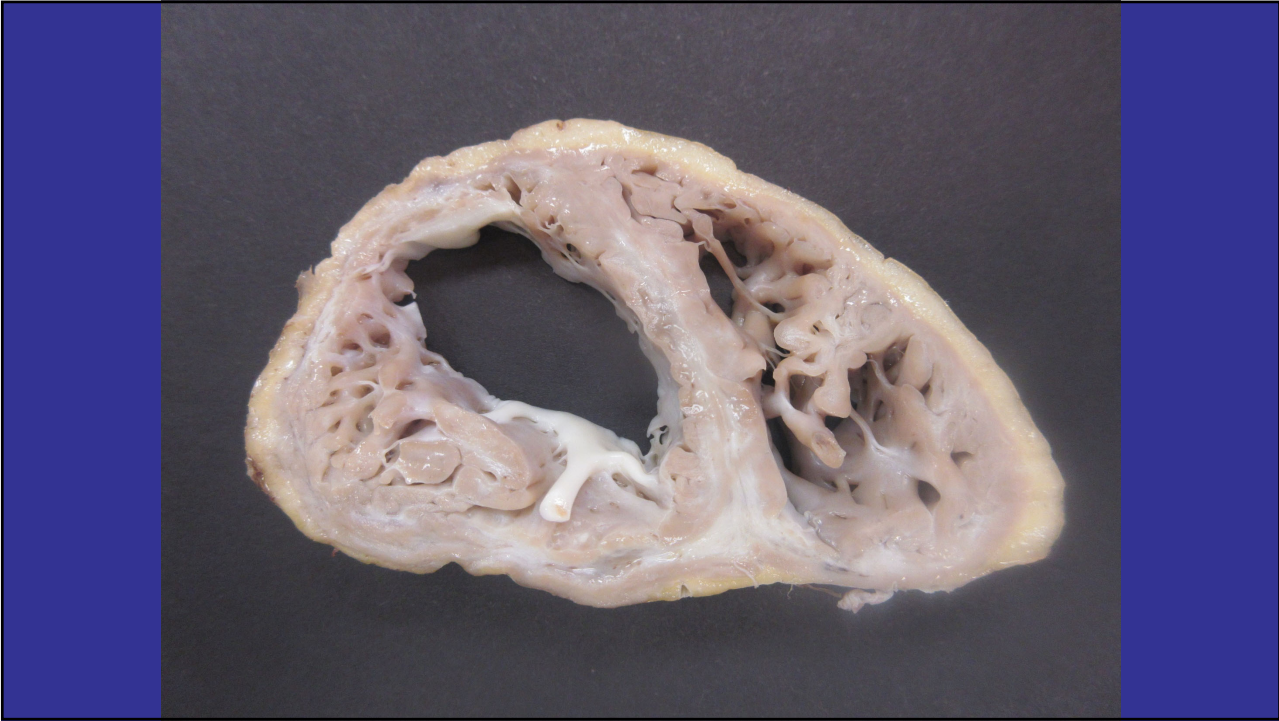
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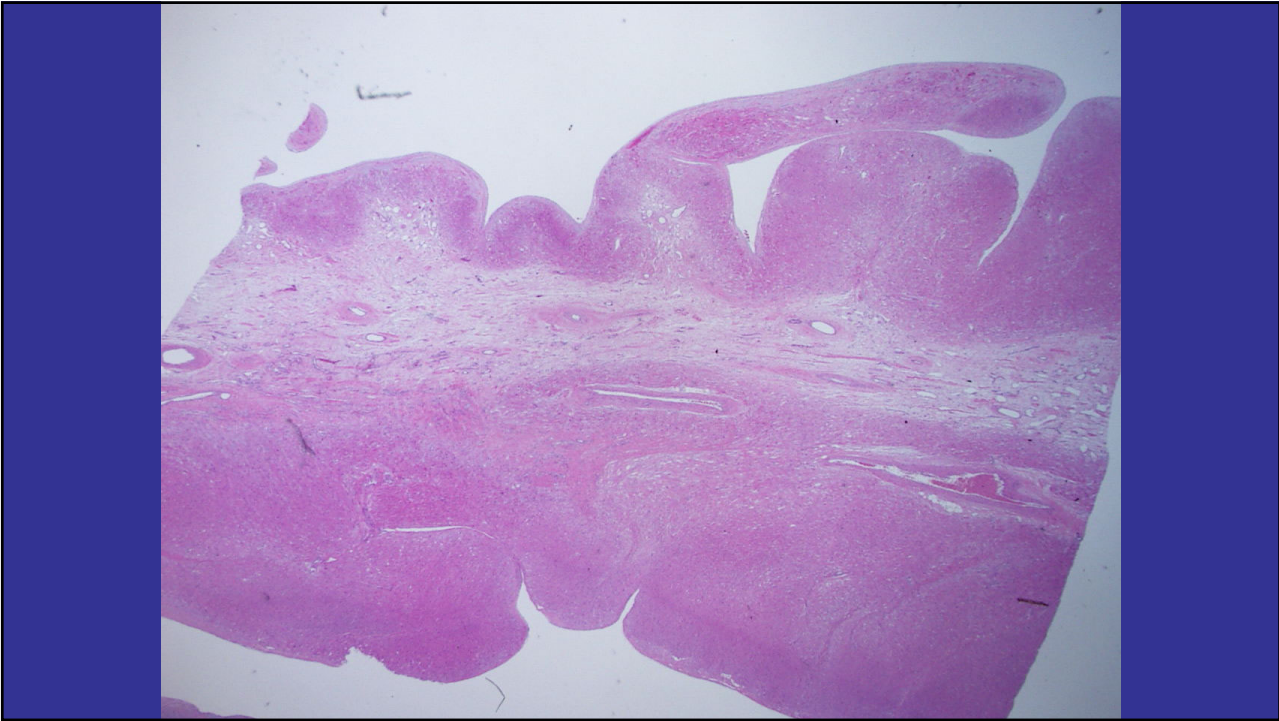
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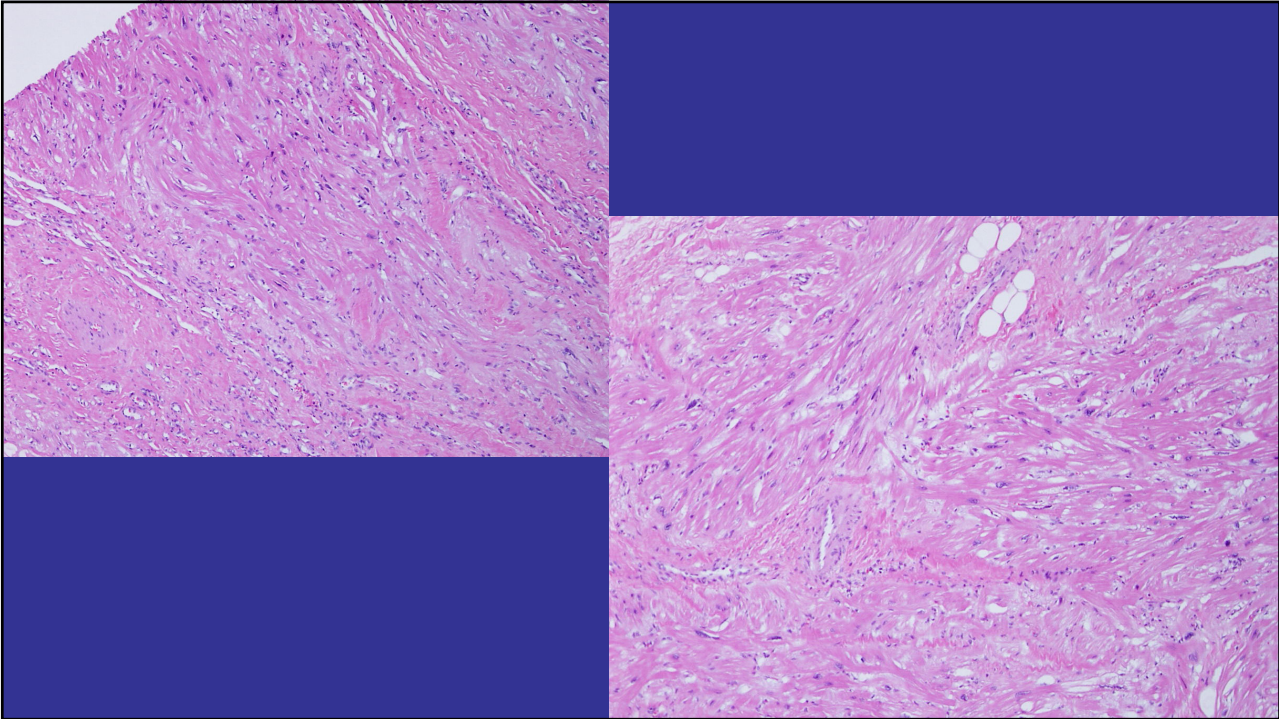
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## Devices

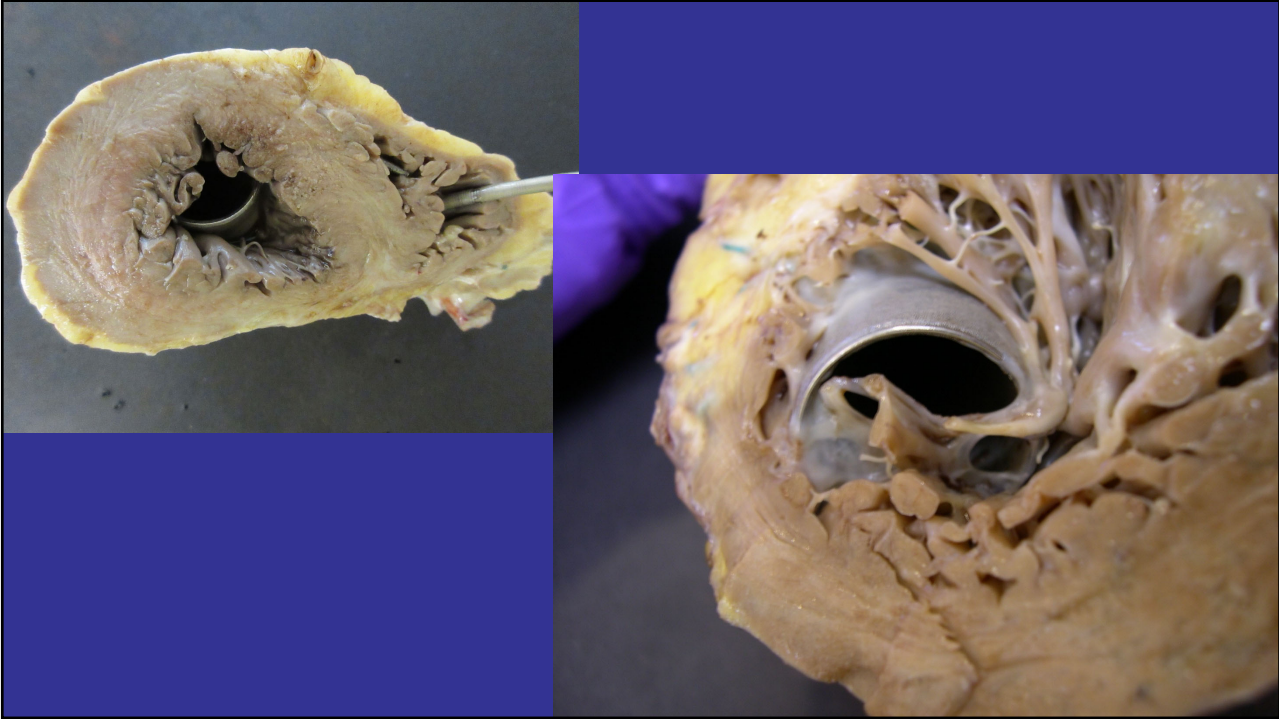
Examine devices present with the heart.

- Clots
- Leaks
- Obstruction

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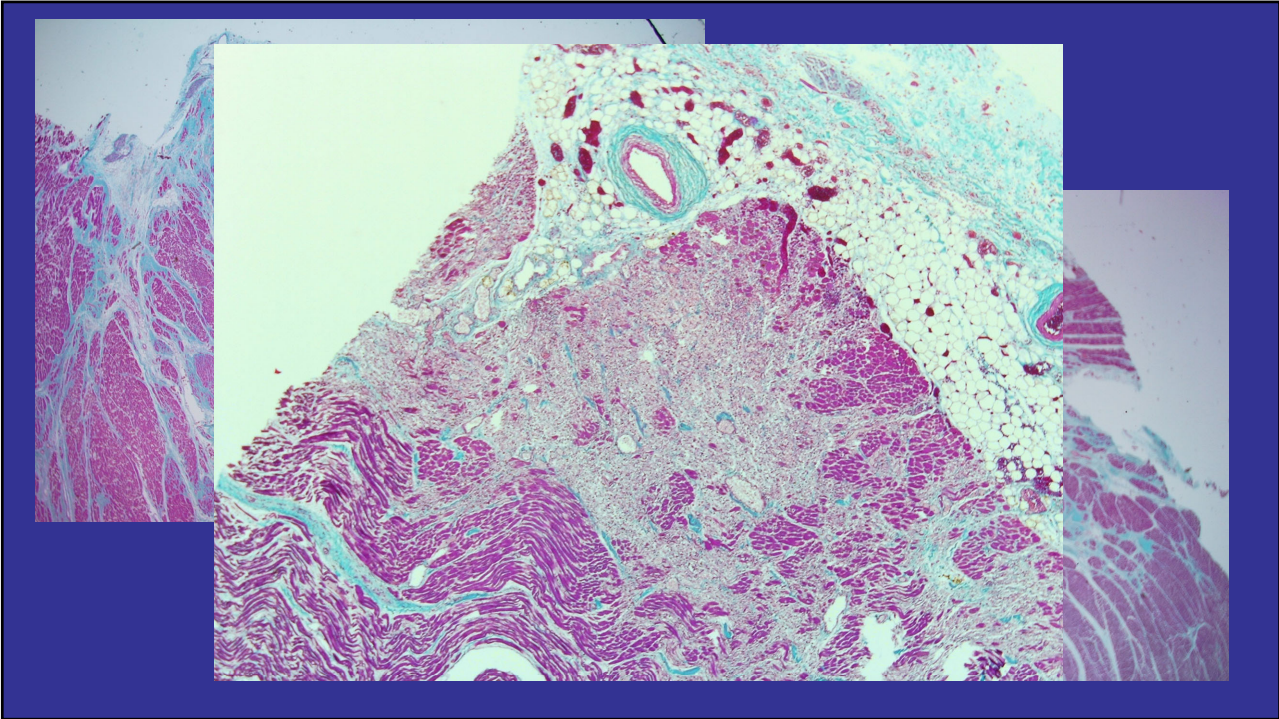
## Collaboration

- 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?

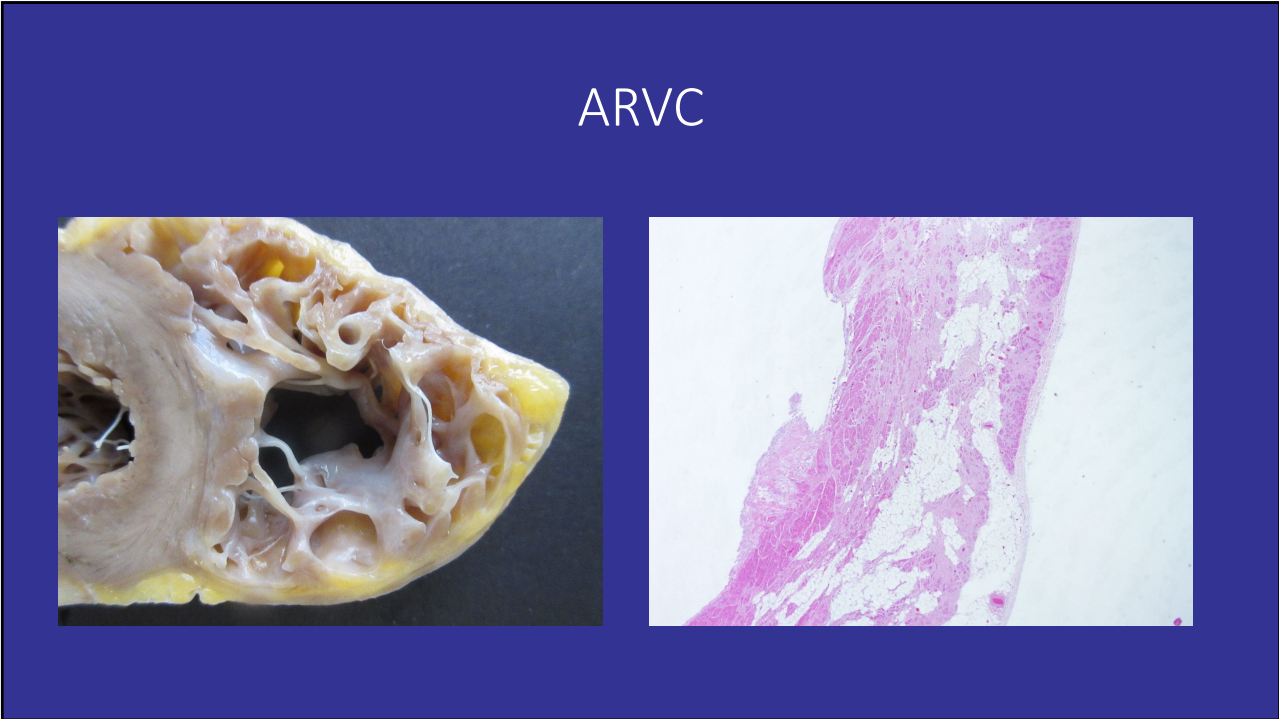
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## Arrhythmogenic cardiomyopathy

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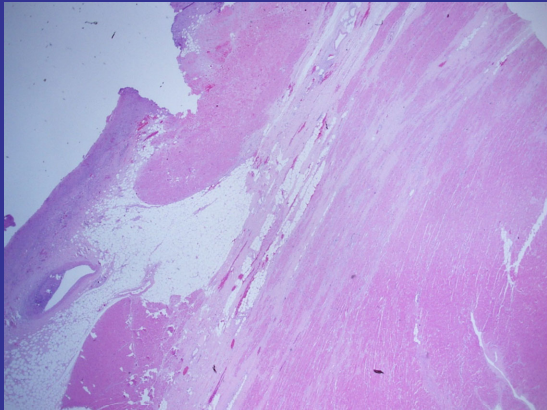
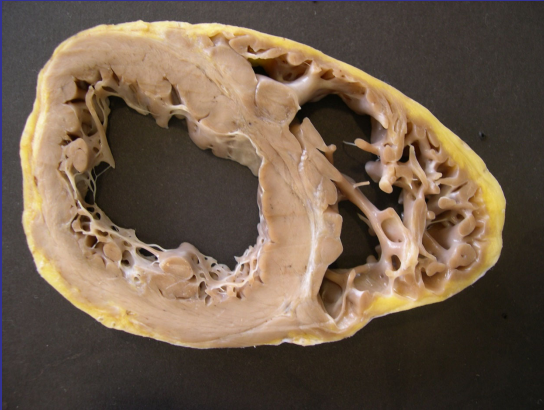


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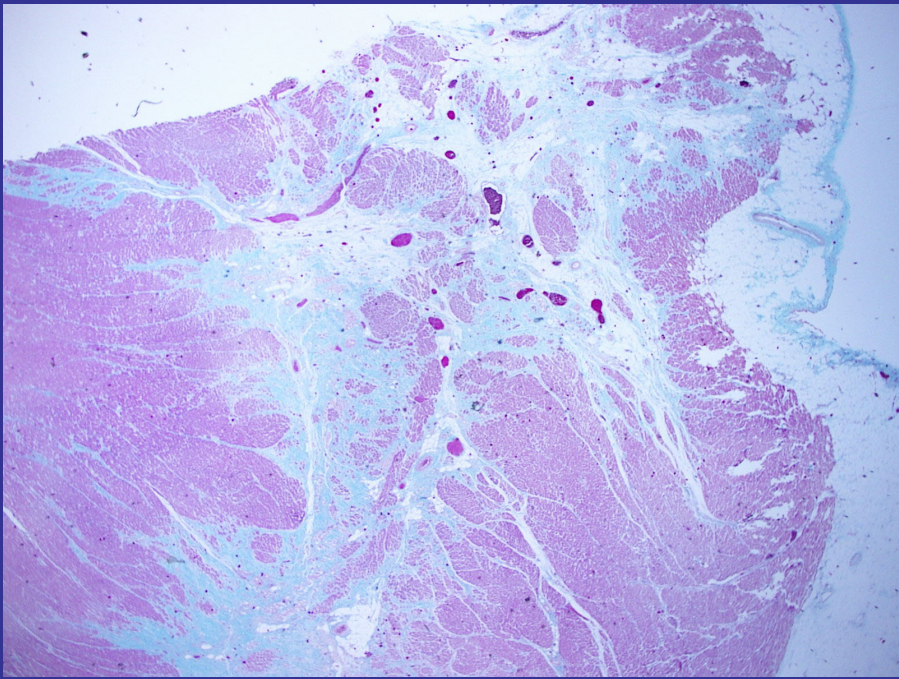


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# Arrhythmogenic cardiomyopathy – ACM or ALVC

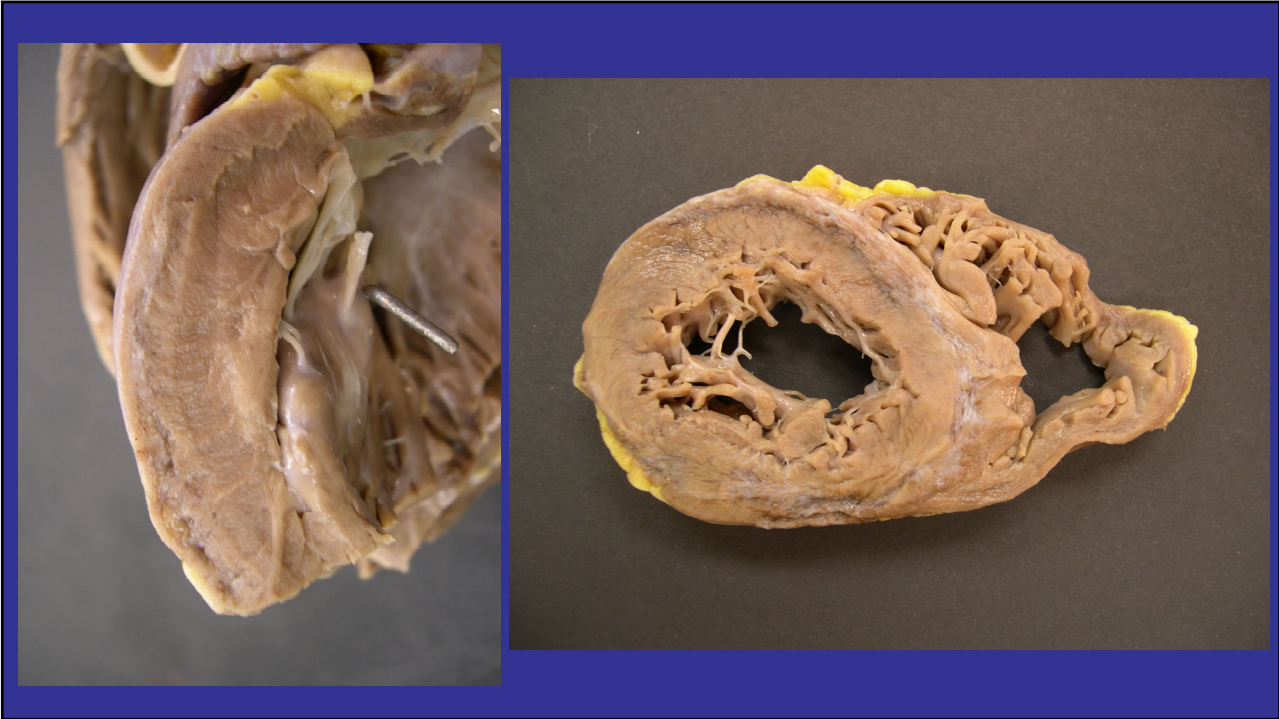


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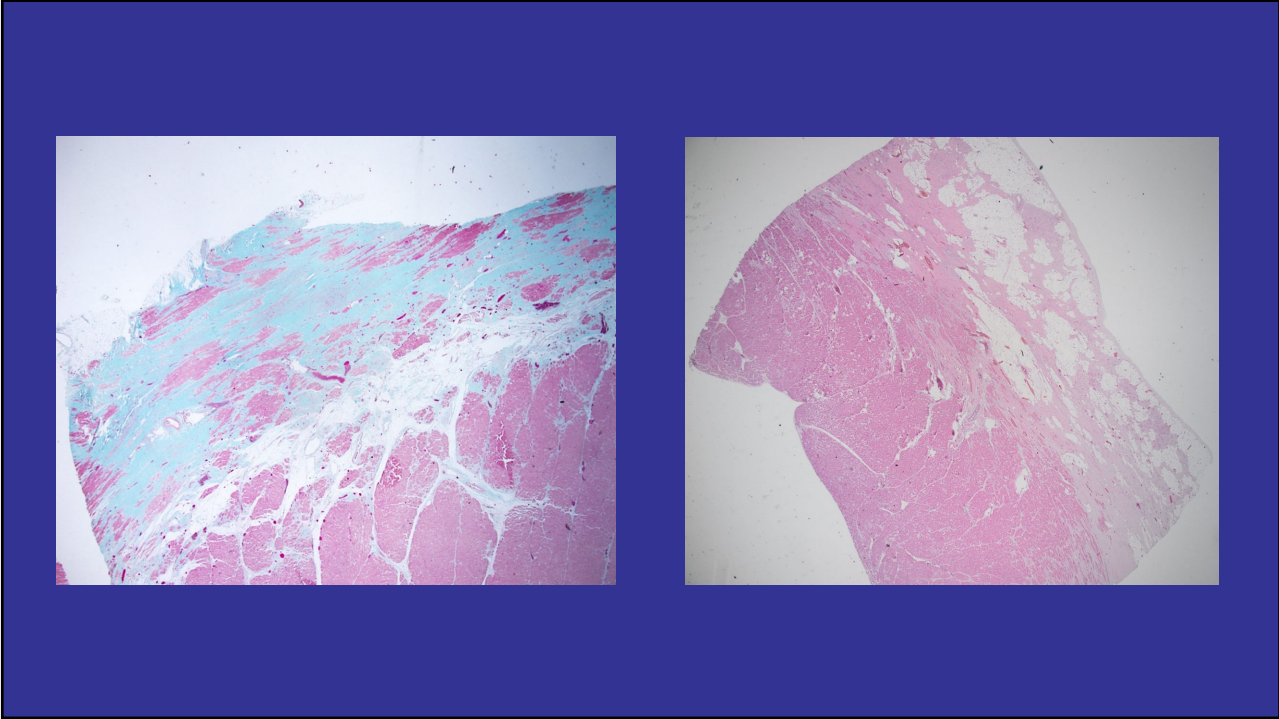


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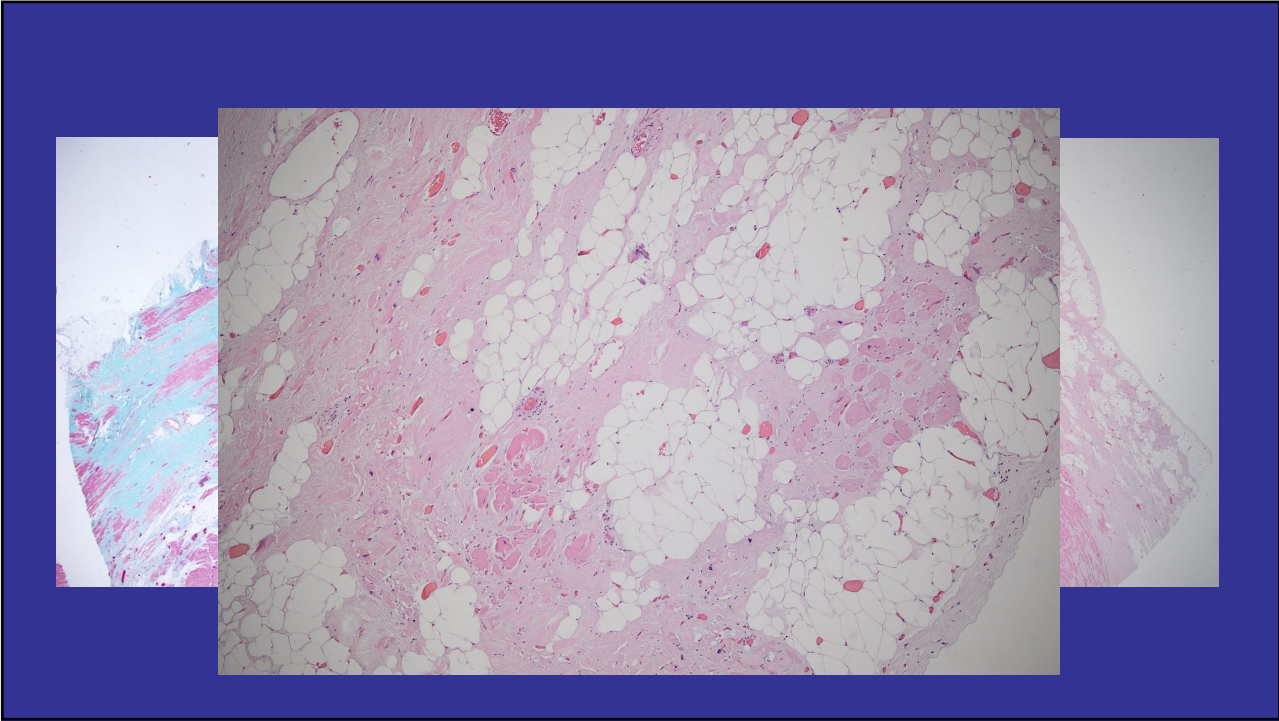




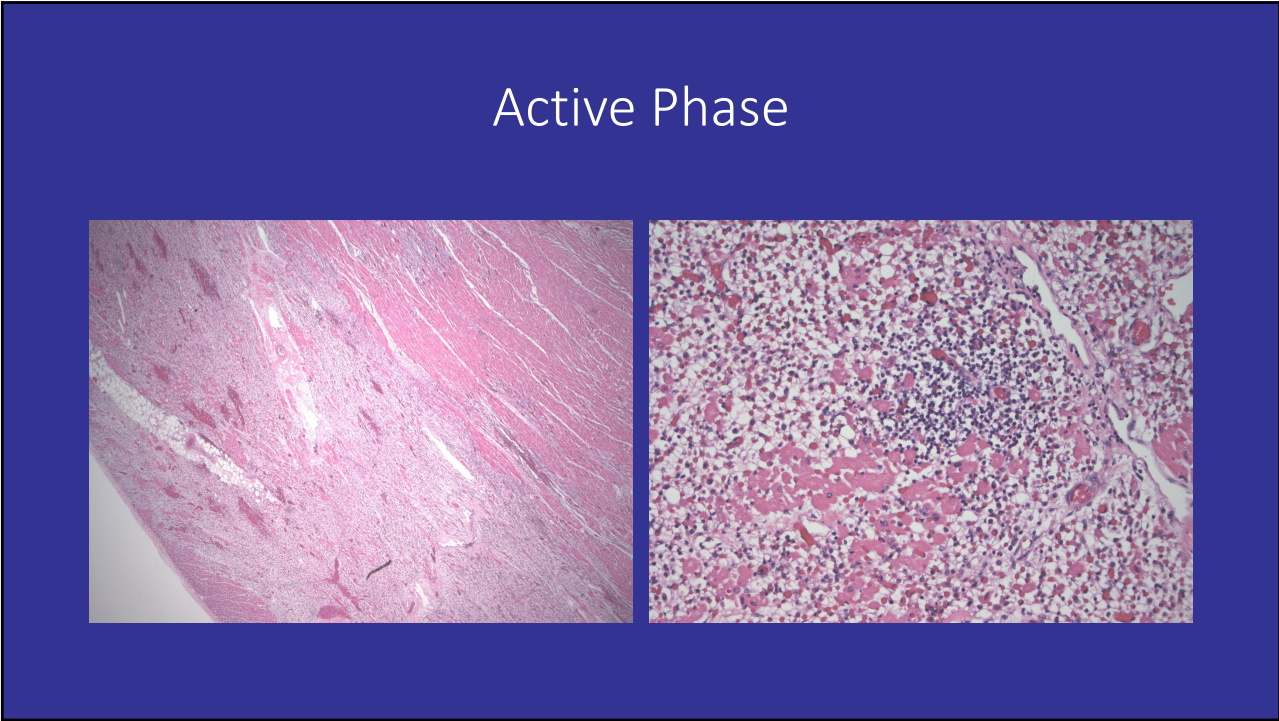
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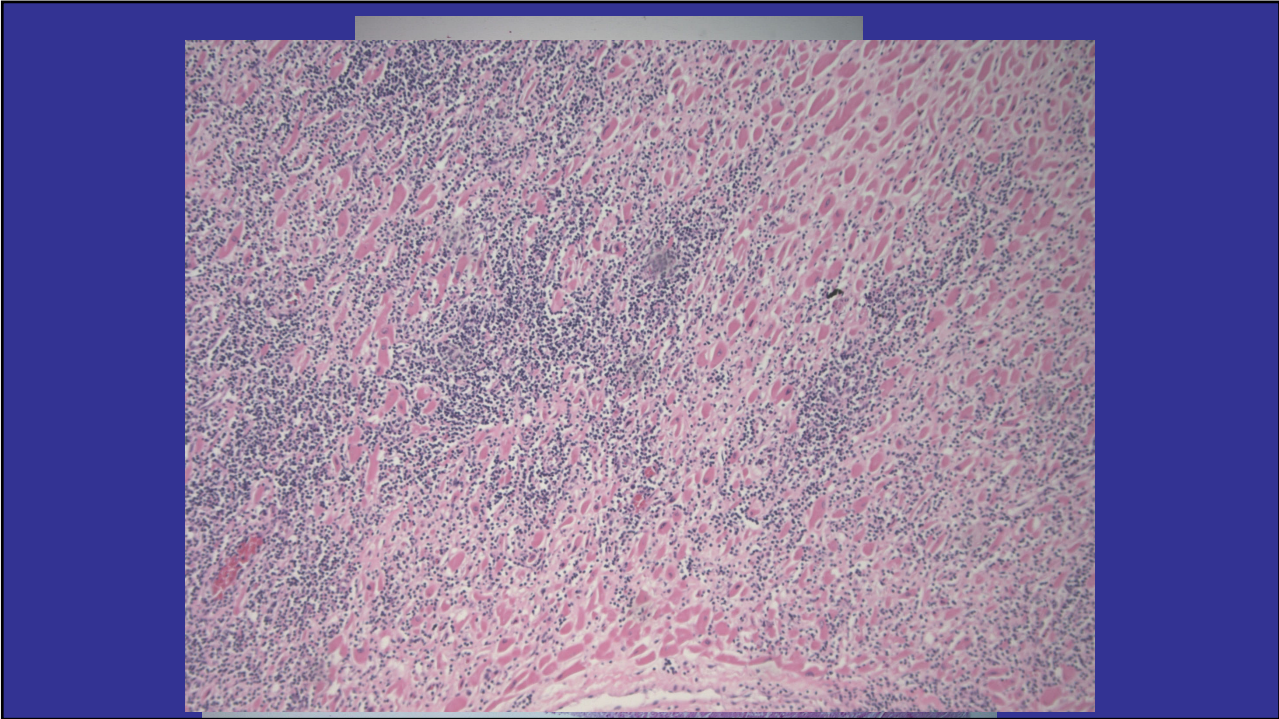
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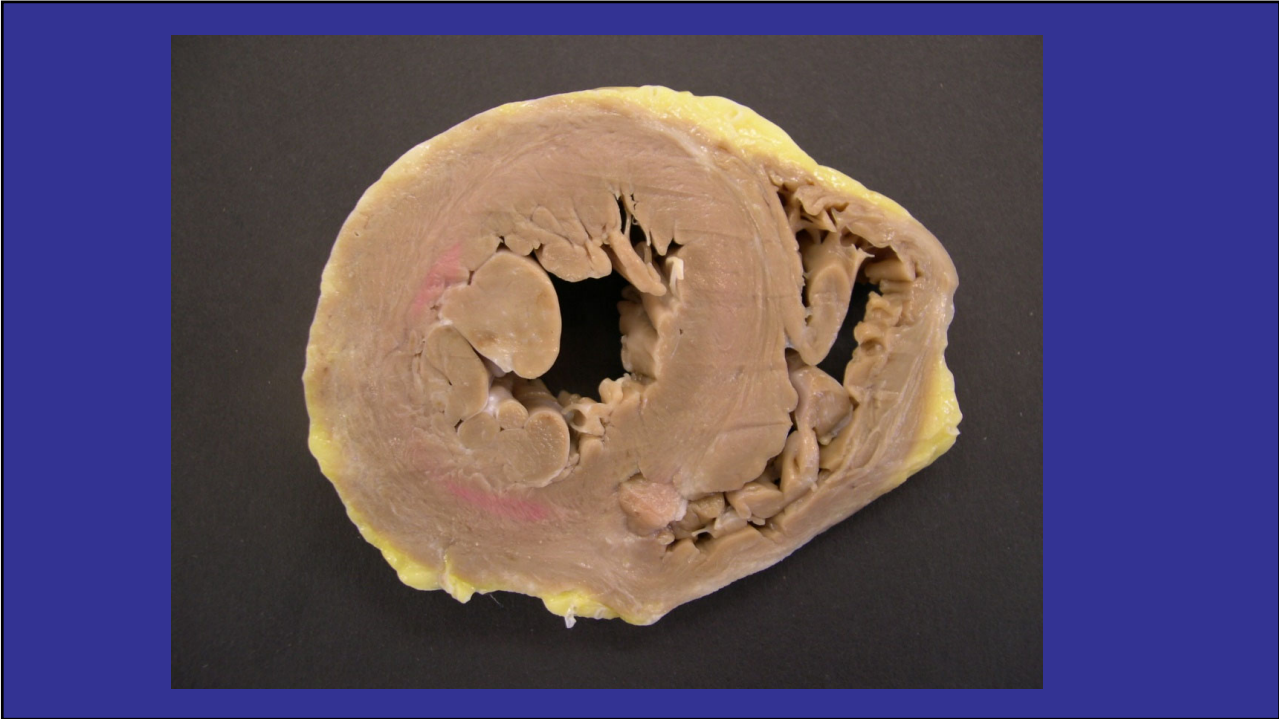


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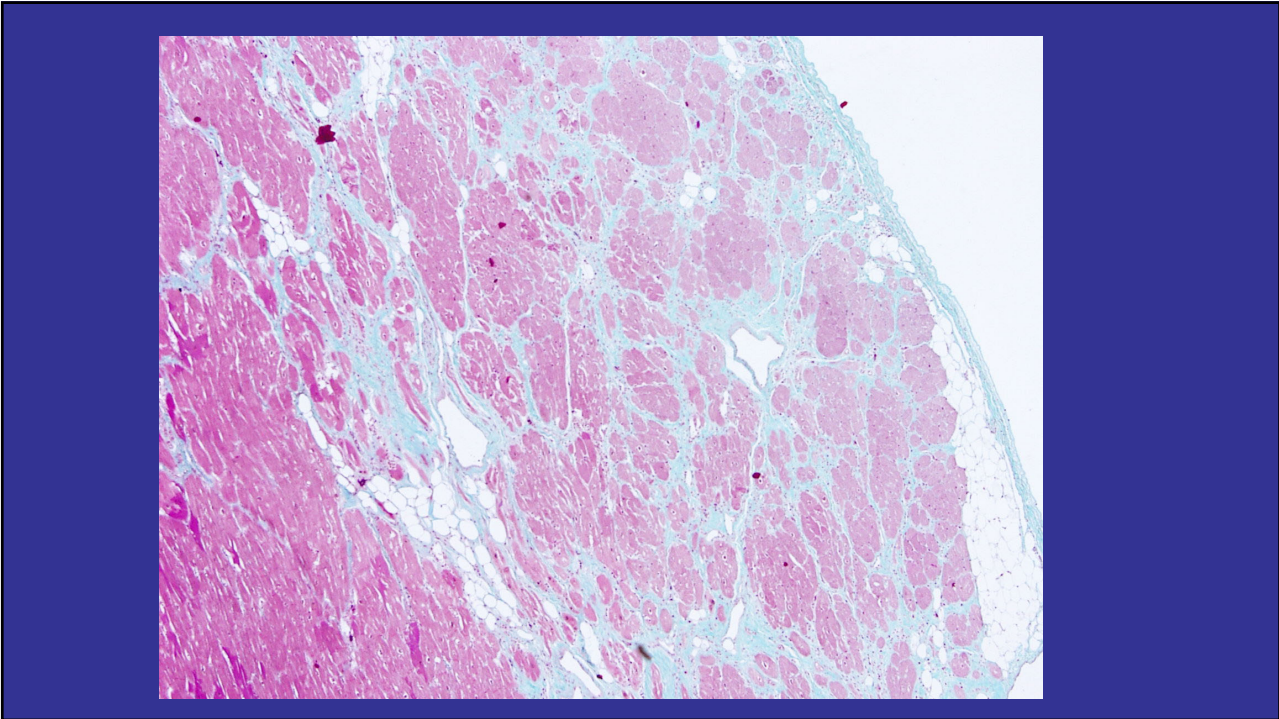
Minimal or no gross findings

This block contains two images. On the left is a gross specimen of a heart, showing a cross-section of the left ventricle with a normal, somewhat yellowish-tan color and a trabeculated internal surface. On the right is a low-magnification histology slide of a heart section stained with H&E, showing the normal architecture of the myocardium with pink muscle fibers and a thin layer of endocardium, with no obvious gross pathology.

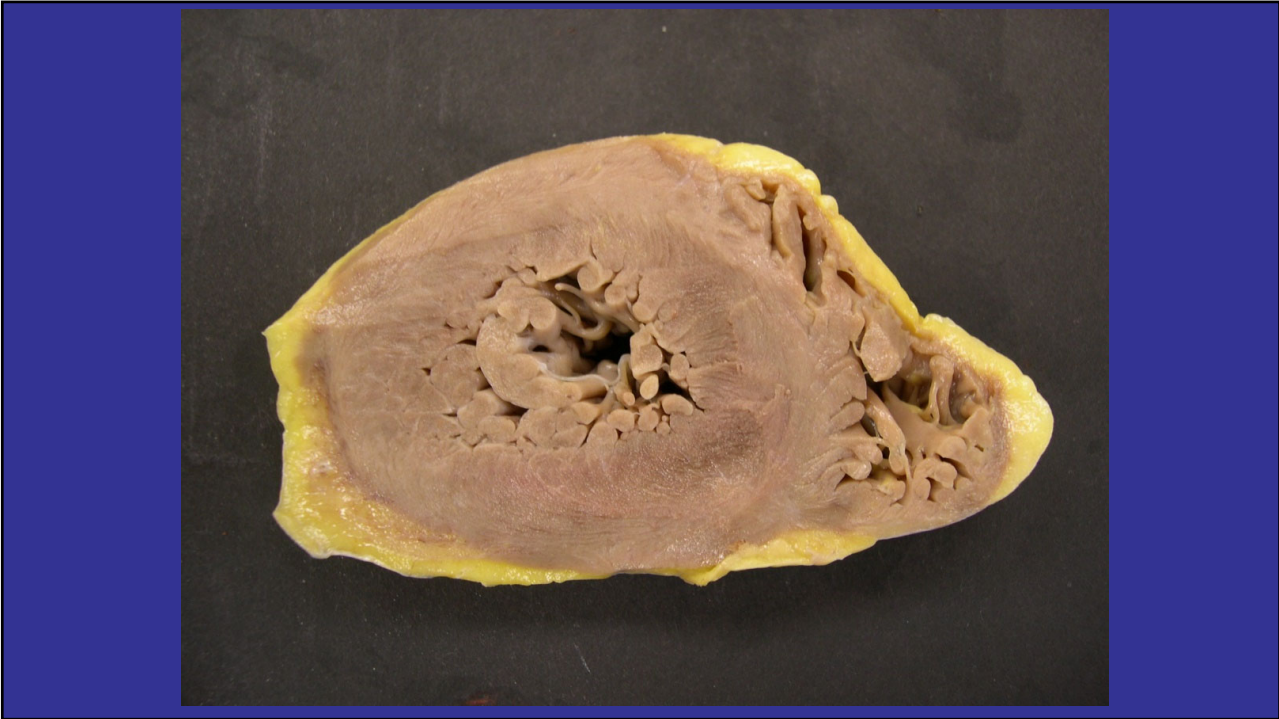
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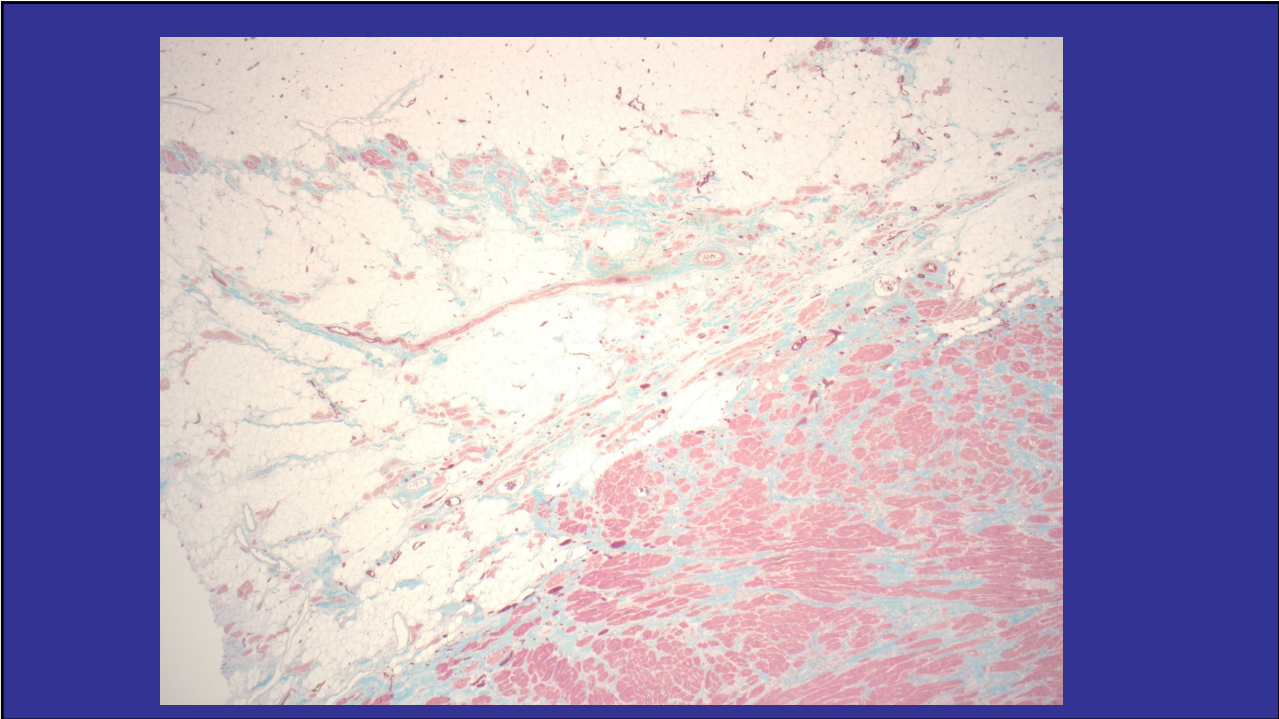
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## COVID-19 and the Heart

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## COVID

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

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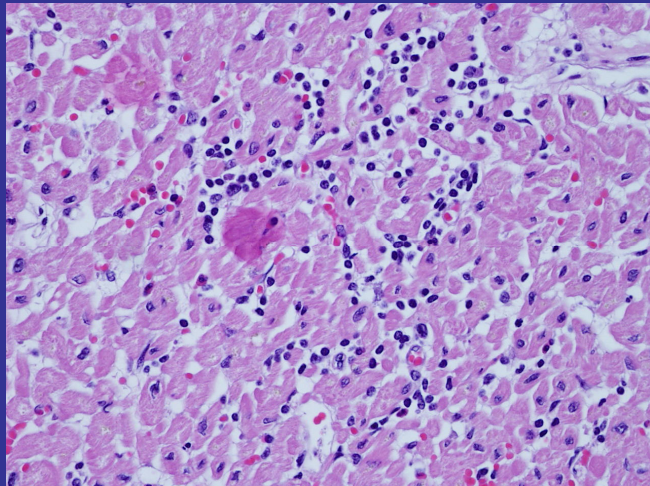
## Cardiac findings

- 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

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## COVID- associated myocarditis

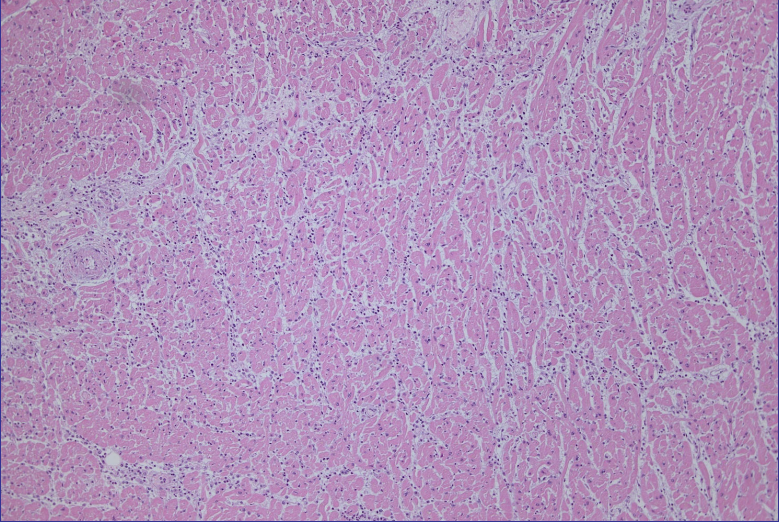
- 3 with myocarditis
  - Inflammation was predominantly lymphocytic with occasional eosinophils.
- Also had diffuse hypereosinophilic myocytes, which is seen with global myocardial hypoperfusion, stress cardiomyopathy and catecholamine response.
  - **Non specific, but indicates cardiac strain/ stress**



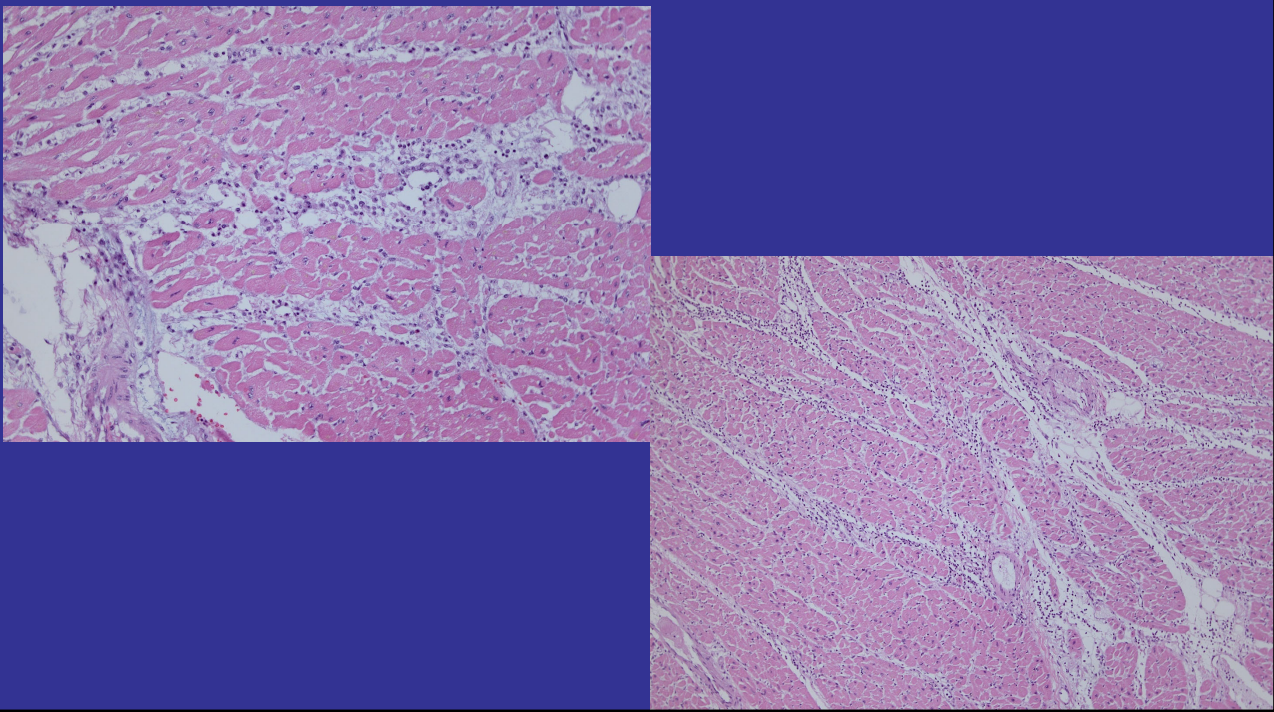
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### COVID associated myocardial damage

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

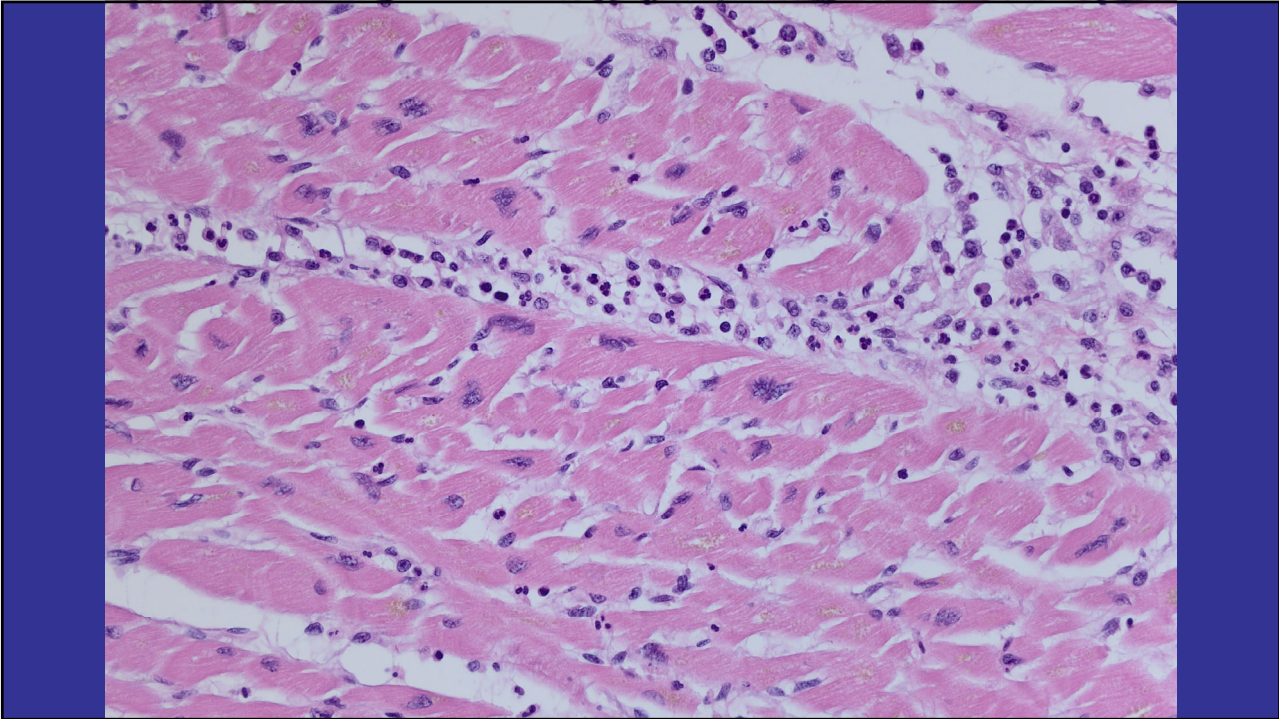
A low-magnification photomicrograph of myocardial tissue stained with hematoxylin and eosin (H&E). The image shows a dense network of pink-stained muscle fibers (myocytes) with visible nuclei. There is significant interstitial inflammation, characterized by a dense infiltration of small, dark-staining nuclei (neutrophils) and some larger, more varied cells (histiocytes, eosinophils, lymphocytes). The inflammation is particularly prominent around blood vessels and in the spaces between muscle fibers. There is also evidence of myocardial ischemia, with some myocytes appearing pale and eosinophilic (hypereosinophilic), and areas of interstitial edema (pale, expanded spaces).

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Two photomicrographs of myocardial tissue. The top-left image shows a cross-section of muscle fibers with a dense infiltrate of inflammatory cells in the interstitium. The bottom-right image shows a similar view with more pronounced interstitial edema and hypereosinophilic myocytes. The top-right and bottom-left corners of the slide are filled with a solid blue color.

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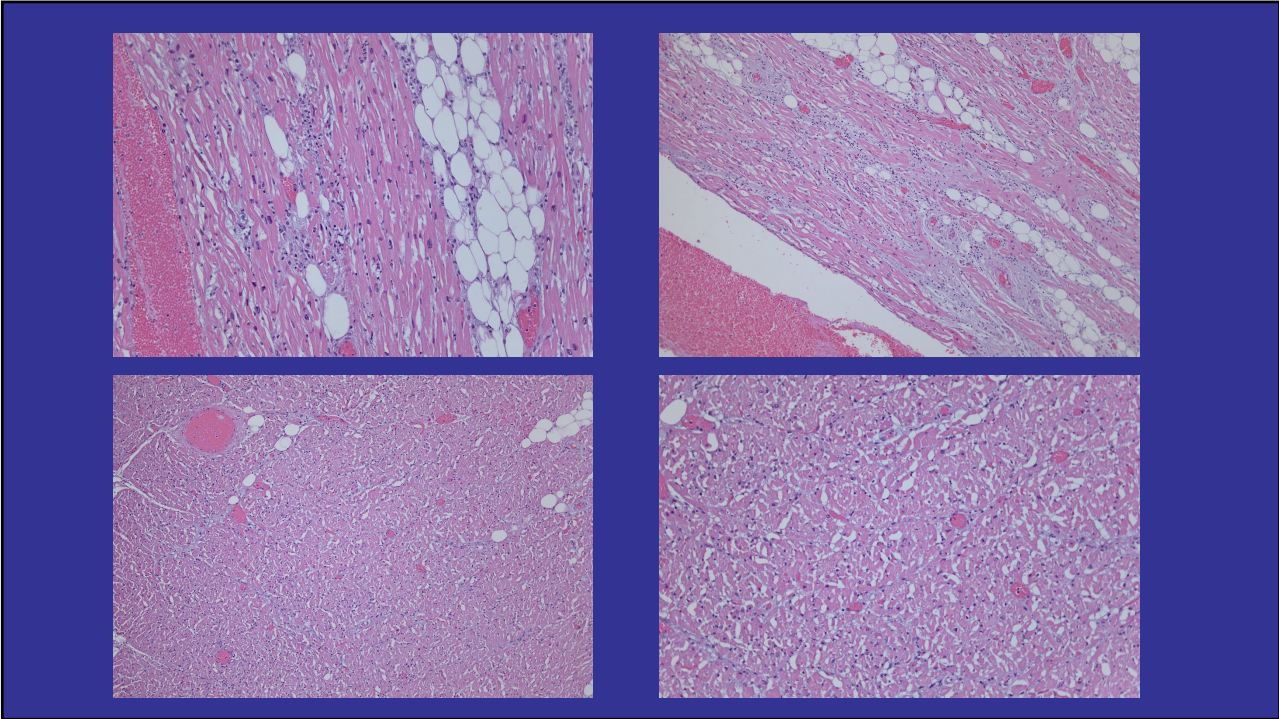
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### Right ventricular strain

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

A low-magnification photomicrograph of a section of the right ventricle stained with H&E. The myocardium is visible as a dense, pink-stained area. There are several areas of hyper eosinophilic myocytes and interstitial inflammation, consistent with the findings in slide 65. The overall structure of the myocardium appears somewhat disorganized, reflecting the strain.

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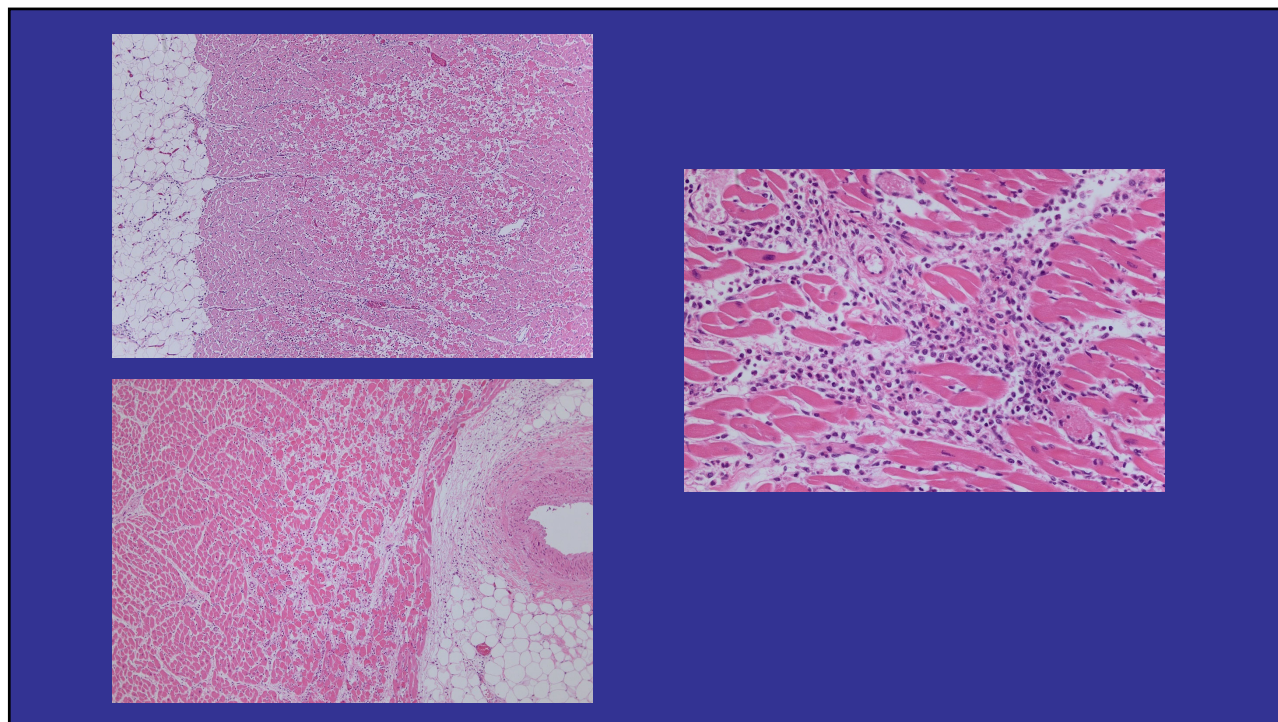


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Post COVID vaccine myocardial inflammation

This block features a title "Post COVID vaccine myocardial inflammation" in white text on a dark blue background. Below the title are two histological images of myocardial tissue. The left image shows a low-magnification view of myocardial fibers with some interstitial inflammation and a few infiltrating cells. The right image shows a higher magnification of the same tissue, clearly demonstrating the inflammatory infiltrate within the interstitium and around the myocardial fibers.

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## 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?

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## Contact Information

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