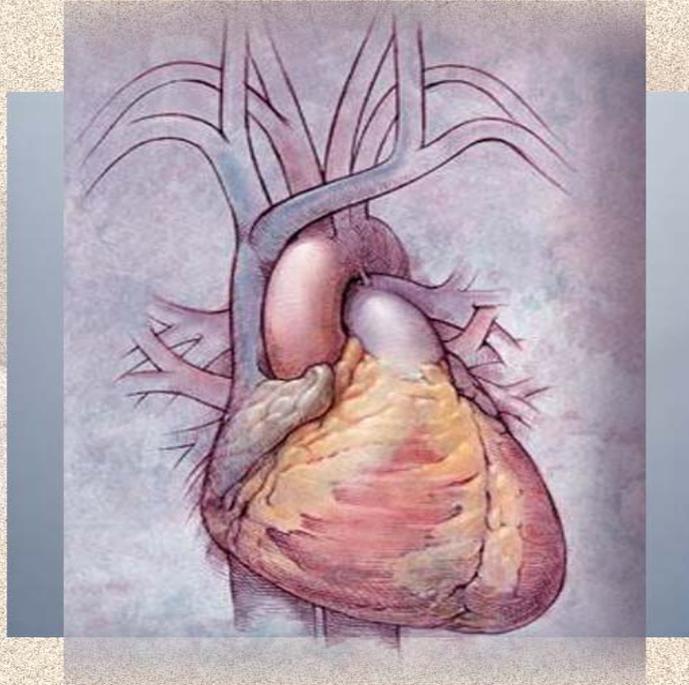


# Advanced Failure Therapies

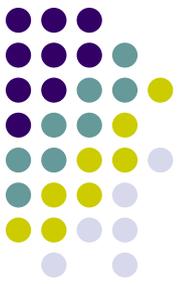


- Tonya Elliott, MSN RN CCTC
  - Inova Heart Transplant



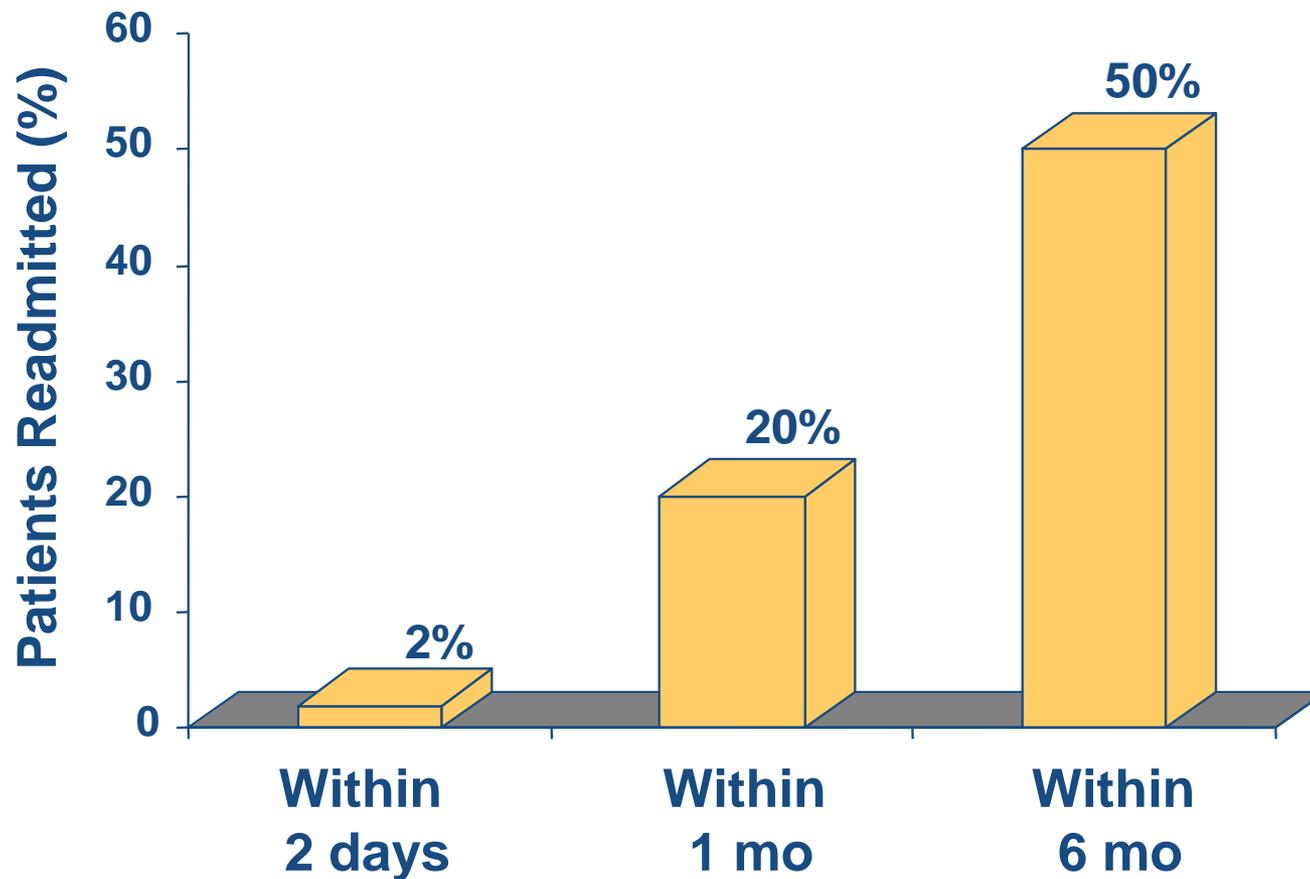


# Heart Failure in US: Growing Epidemic

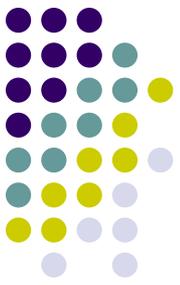


- Affects ~5.5 million patients<sup>1</sup>
  - ~1 of every 100 people >65 yr
  - 550,000 new cases each yr
- Mortality
  - 33% at 1 yr<sup>2</sup>
  - 50% at 5 yr<sup>3</sup>
  - In-hospital 3.9%<sup>4</sup>

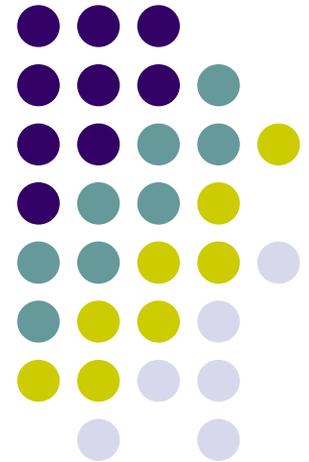
# HF Readmission Rates



# Medication Noncompliance or mistakes = 24% readmission

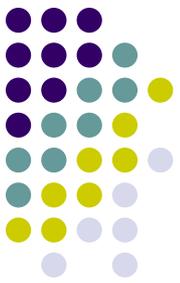


# Pathophysiology of ADHF





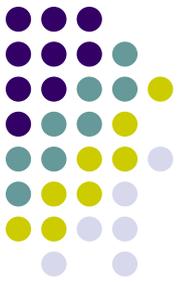
# Acute Decompensated Heart Failure (ADHF)



HF, a complex clinical syndrome, can result from any *structural* or *functional* cardiac disorder that impairs ability of ventricle to *fill* with or *eject* blood.

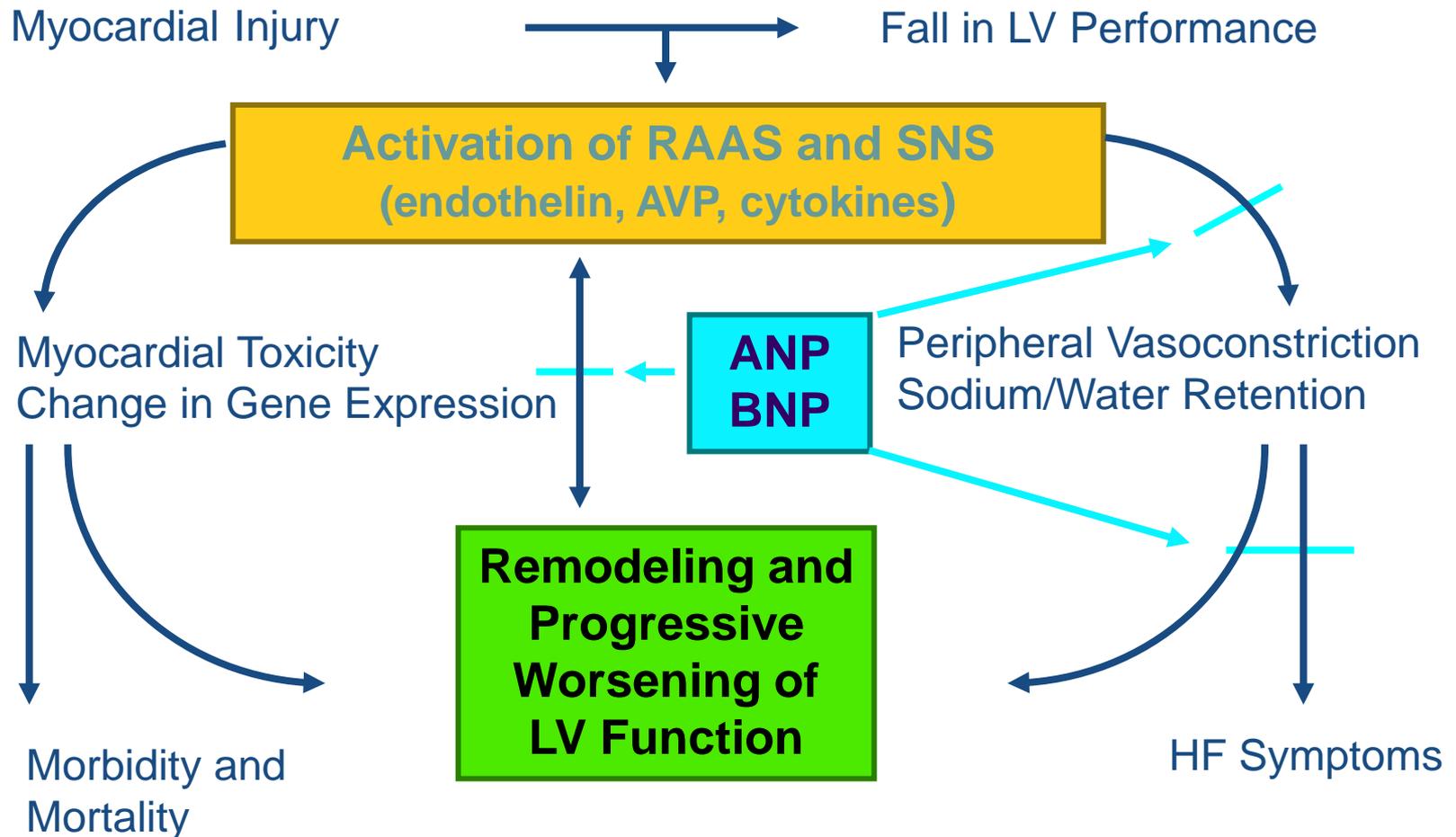
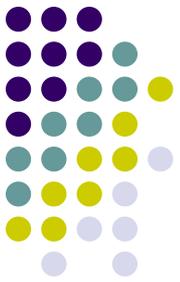
Cardinal symptoms are fatigue and dyspnea, and clinical signs are fluid retention and exercise intolerance

# Heart Failure with Normal EF

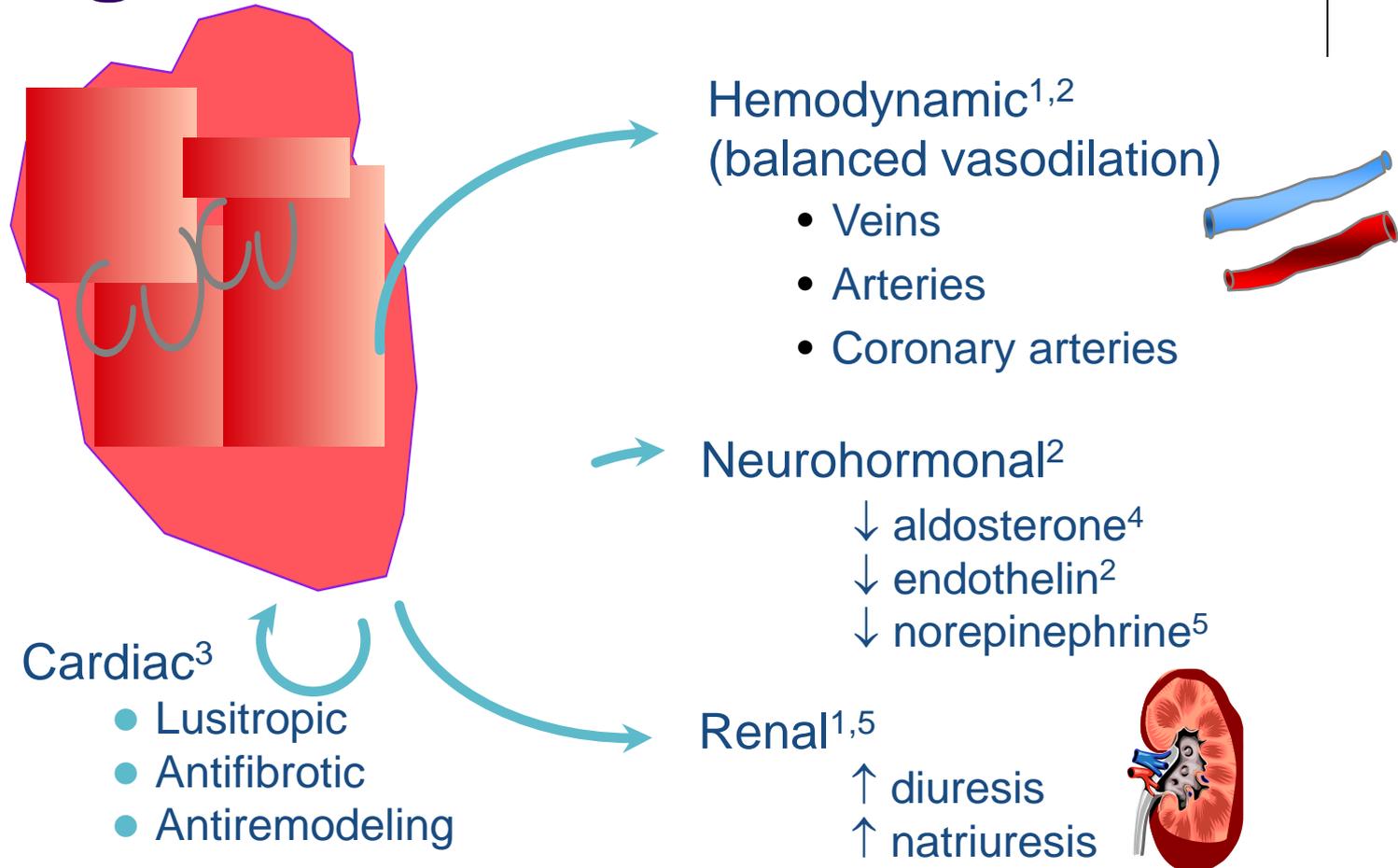


- Old term: Diastolic Heart Failure
- 20-50% of all heart failure patients
- Elderly, often female, usually obese/history of HTN and diabetes
- Mortality high, hospitalization rates are equal
- Standard therapies not well studied in randomized trials, BUT treatment with diuretics, agents to slow heart rate, ACE-I/ARB, and spironolactone usually recommended

# Pathophysiology of ADHF



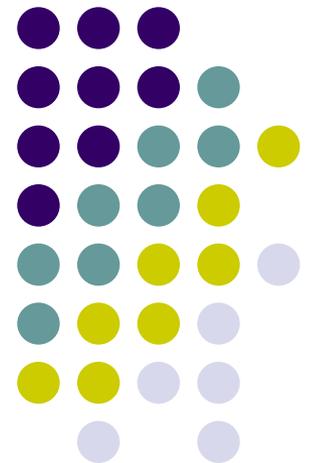
# Physiologic Actions of Endogenous hBNP



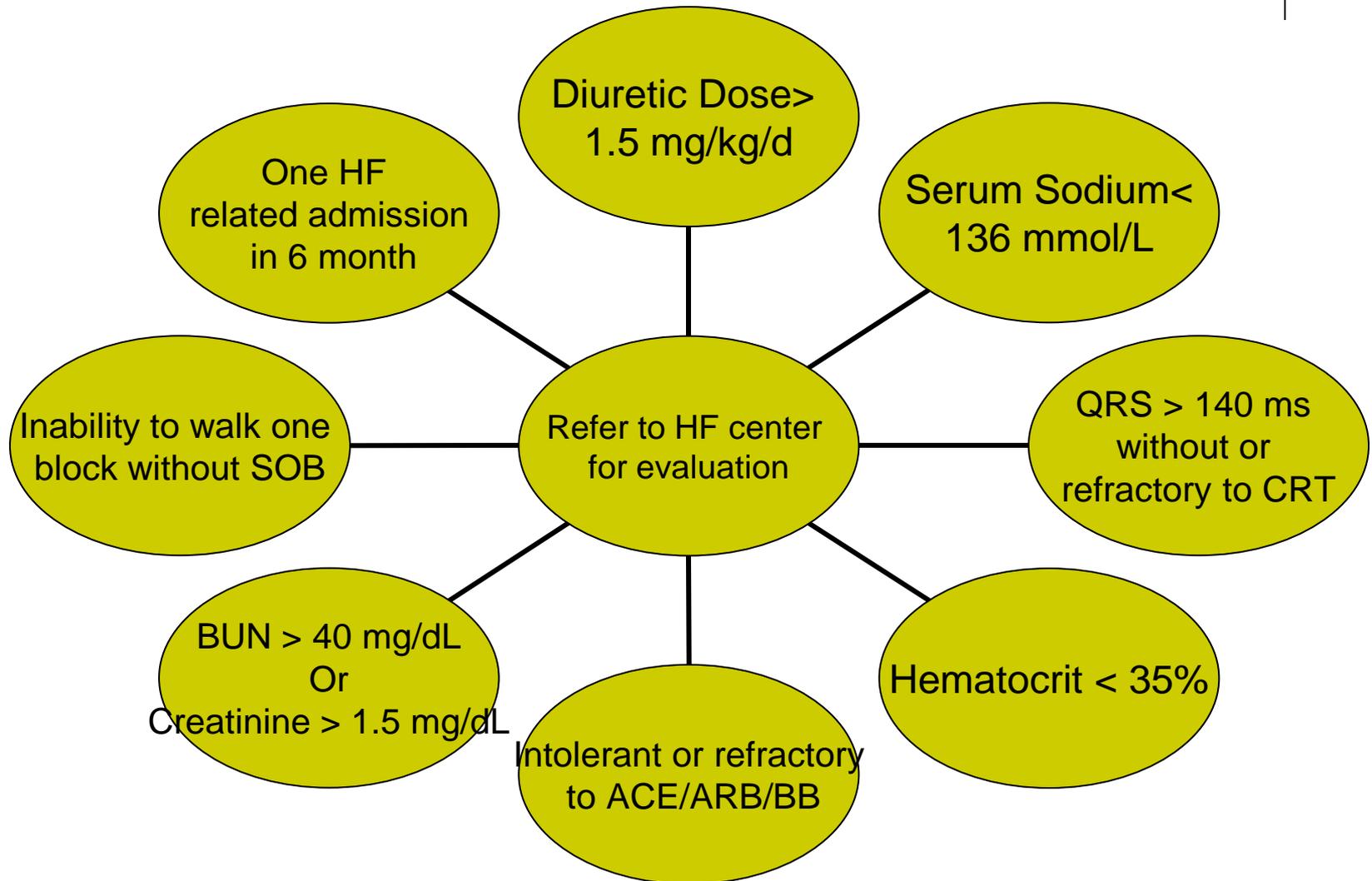
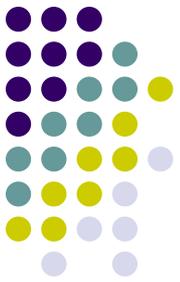
<sup>1</sup>Marcus LS et al. *Circulation*. 1996;94:3184; <sup>2</sup>Zellner C et al. *Am J Physiol*. 1999;276(3 pt 2):H1049; <sup>3</sup>Tamura N et al. *Proc Natl Acad Sci U S A*. 2000;97:4239; <sup>4</sup>Abraham WT et al. *J Card Fail*. 1998;4:37; <sup>5</sup>Clemens LE et al. *J Pharmacol Exp Ther*. 1998;287:67

# Patient Assessment, Identification, and Treatment

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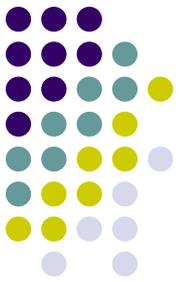


# Patient referral guidelines



# ADHERE<sup>®</sup> Registry Demographics

All Enrolled Discharges (N = 105,388) October 2001–January 2004

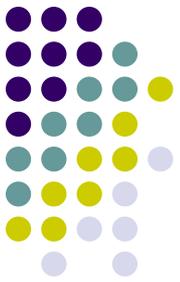


	The Nation
<b>Median Age (yr)</b>	<b>75.0</b>
<b>Gender (%)</b>	
<b>Male</b>	<b>48</b>
<b>Female</b>	<b>52</b>
<b>Race/Ethnicity (%)</b>	
<b>Asian</b>	<b>&lt;1</b>
<b>Black</b>	<b>20</b>
<b>Hispanic</b>	<b>3</b>
<b>White</b>	<b>72</b>
<b>Other</b>	<b>1</b>
<b>Primary Insurance (%)</b>	
<b>Medicare</b>	<b>72</b>
<b>Medicaid</b>	<b>7</b>
<b>Commercial FFS/PPO</b>	<b>8</b>
<b>HMO</b>	<b>8</b>
<b>None/Self-Pay</b>	<b>3</b>
<b>VA/Champus</b>	<b>1</b>
<b>Other</b>	<b>2</b>
<b>In Experimental Trial</b>	<b>1</b>

Data on file. Scios Inc.

# Past Medical History

All Enrolled Discharges (N = 105,388) October 2001–January 2004



## The Nation

<b>CAD (%)</b>	<b>57</b>
<b>MI (%)</b>	<b>31</b>
<b>Hypertension (%)</b>	<b>72</b>
<b>Hyperlipidemia/Dyslipidemia (%)</b>	<b>35</b>
<b>Cardiac Valvular Disease (%)</b>	<b>23</b>
<b>Stroke or TIA (%)</b>	<b>17</b>
<b>Atrial Fibrillation (%)</b>	<b>31</b>
<b>Ventricular Tachycardia (%)</b>	<b>9</b>
<b>Ventricular Fibrillation (%)</b>	<b>1</b>
<b>Pacemaker or ICD (%)</b>	<b>20</b>
<b>LVAD (%)</b>	<b>&lt;1</b>
<b>IABP (%)</b>	<b>&lt;1</b>
<b>Peripheral Vascular Disease (%)</b>	<b>18</b>
<b>Chronic Renal Insufficiency (%)</b>	<b>30</b>
<b>Chronic Dialysis (%)</b>	<b>5</b>



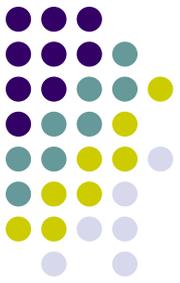
# Past Medical History

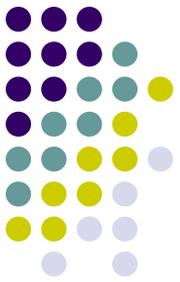
All Enrolled Discharges (N = 105,388) October 2001–January 2004

	The Nation
Diabetes (%)	44
Insulin-Dependent Diabetes (%)	18
Liver Disease (%)	3
Thyroid Disease (%)	18
COPD or Asthma (%)	31
Active Malignancy (%)	5
Ever Smoked (%)	48
Current Smoker (%)	13

# Treatments

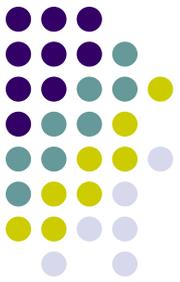
- Oral medications
- IV medications
- Devices
- Heart replacement





# Optimizing Therapies

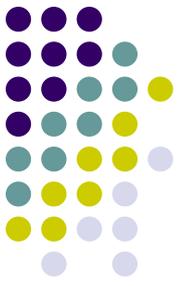
- ACE - inhibitors for stages B, C, D
- ARB for ACE - intolerant, probably similar efficacy
- Beta Blockers for Stages B, C, D
  - Carvedilol
  - Long acting metoprolol



# Optimizing Therapies

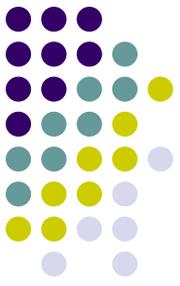
- Digoxin for symptomatic pts. low EF
  - Level  $<0.9$  ng/ml
- Cardiac Resynchronization Therapy for bundle branch block
- Aldosterone antagonist, stage C, D (NYHA III or IV)
  - Spironolactone
  - Eplerenone
- Consider hydralazine/nitrates (A-HeFT trial)
  - if no ACE or ARB

# Use of Inotropes

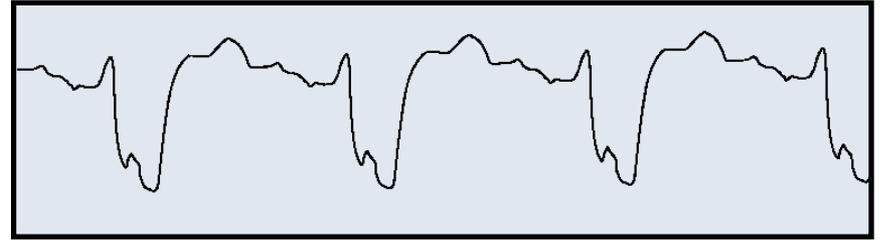


- The use of intermittent Inotropes has fallen out of favor.
- Continuous Inotropes should be started only after oral medications have been optimized and the patient has demonstrated that he/she can not be weaned without slipping back into CHF.
- ICDs should be implanted if the patient is going to be discharged on a continuous infusion.

# Cardiac Resynchronization Therapy

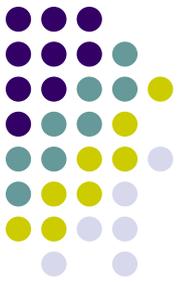


- Cardiac resynchronization, in association with an optimized AV delay, improves hemodynamic performance by forcing the left ventricle to complete contraction and begin relaxation earlier, allowing an increase in ventricular filling time.
- Coordinate activation of the ventricles and septum.



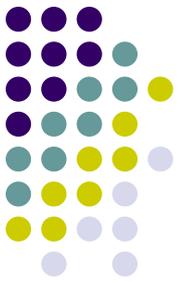
**ECG depicting cardiac resynchronization**

# Heart Replacement Therapy

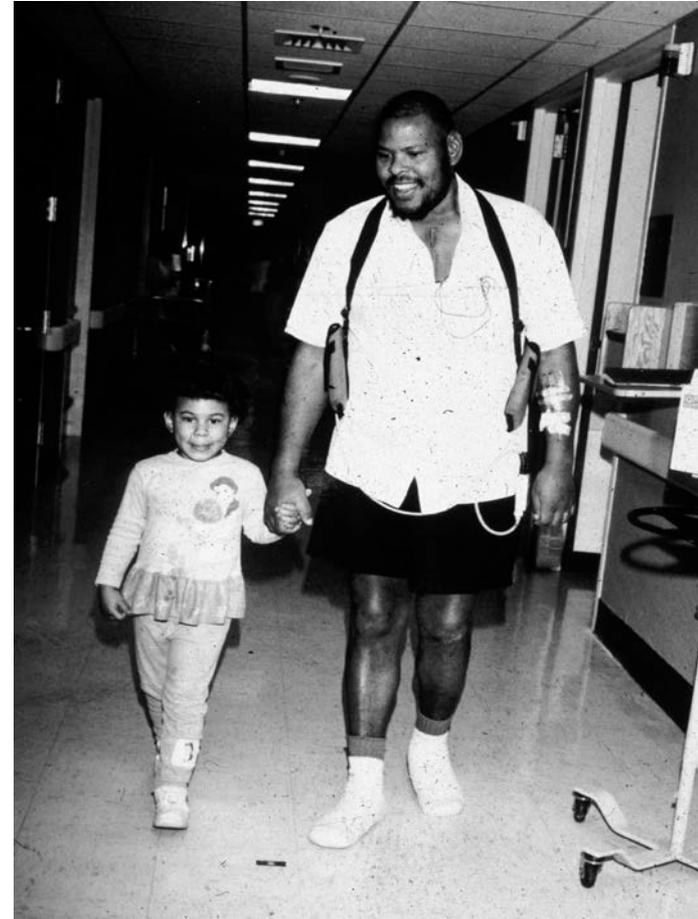


- Mechanical Circulatory Support
  - Ventricular Assist Devices
  - Total Artificial Heart
- Heart Transplant

# First VAD implant Feb 1990

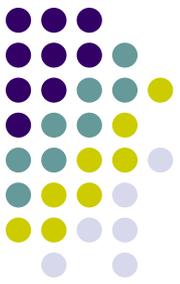


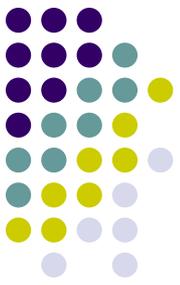
- First Ventricular assist devices were actually implanted in the 1980's
- The first pneumatic LVAD patient was implanted in Feb 90 and is still alive.
- LVAD patients discharged with device Sept 1998.
- Destination Therapy approved in 2003.





# Who are the patients?

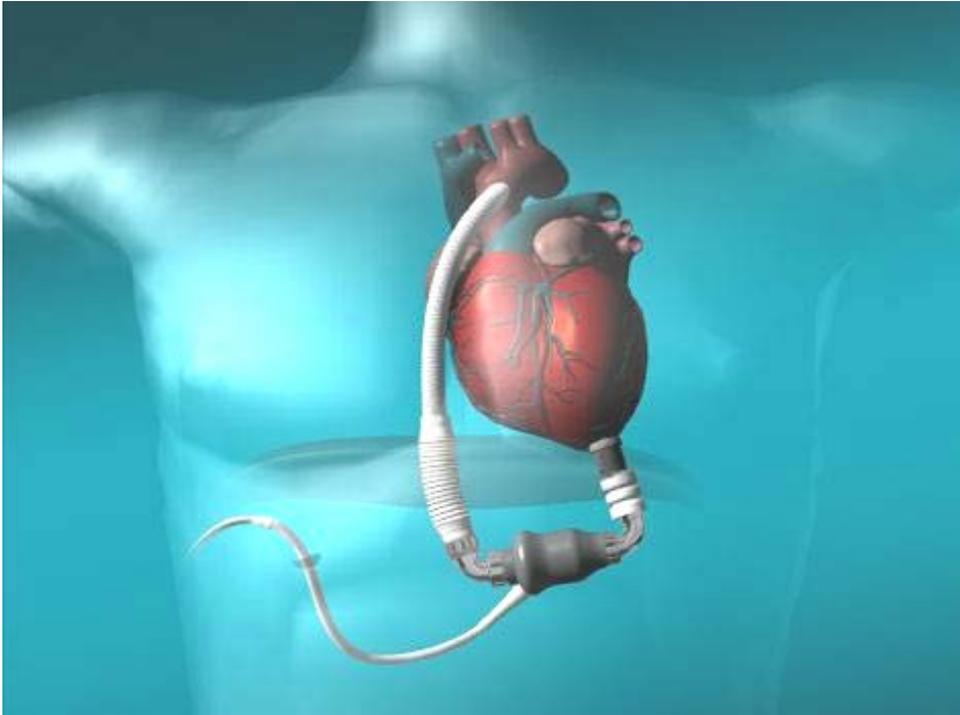
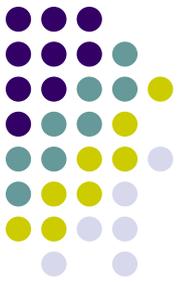




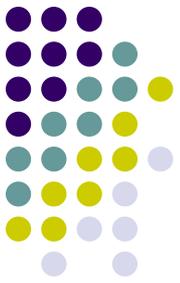
# Pump Comparison

- First generation:
    - Heart Mate XVE
    - PVAD/IVAD
  - Volume displacement
  - HAVE a pulse
  - HAVE a blood pressure
  - Don't do chest compressions
  - Find the hand pump
- Second generation:
    - Heart Mate II
    - Heart Ware
  - Impeller or Centrifugal Laminar Flow
  - NO pulse
  - NO blood pressure
  - NO hand pump

# Second and Third Generation

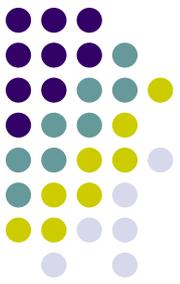


# Changes in the MCS strategy

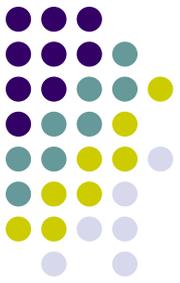


- Destination Therapy
- Longer wait times on transplant list
- Smaller external components
- Longer lasting batteries
- More states allow VAD patients to drive
- Travel

# Sept 11, 2001

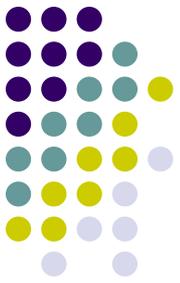


# MARPH to MCSO



- INOVA Fairfax Hospital
- Washington Hospital Center
- University of Maryland
- Johns Hopkins University
- Medical College of Virginia
- Chicago
- State of Florida

# Color Guides Coding



- Heart Mate II
  - Heartware
  - Jarvik
  - VentrAssist
  - Thoratec PVAD
  - Heart Mate XVE
  - Levacor
- Orange
- Dark Blue
- Lavender
- Green
- Light Blue
- Yellow
- Pink

# Field Guides



ORANGE ORANGE ORANGE ORANGE ORANGE

## HeartMate II®

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1. Can I do external CPR?  
Only if absolutely necessary
2. If not, is there a "hand pump" or external device to use?  
No.
3. If the device slows down (low flow state), what alarms will go off?  
A red heart alarm light indicator and steady audio alarm will sound if less than 2.5 l/min.
4. How can I speed up the rate of the device?  
Check for hypovolemia or right heart failure and treat
5. Do I need to heparinize the patient if it slows down?  
Usually no, but you will need to check with implanting center
6. Can the patient be defibrillated while connected to the device?  
Yes
7. If the patient can be defibrillated, is there anything I have to disconnect before defibrillating?  
No.
8. Does the patient have a pulse with this device?  
May have weak pulse or lack of palpable pulse.
9. What are acceptable vital sign parameters?  
MAP 70-90 mm Hg with a narrow pulse pressure
10. Can this patient be externally paced?  
Yes.

Adapted from Swank, L., and Webb, J., A. Mechanical Circulatory Devices in Transport in AHA/ASA Patient Transport Principles and Practice, 4th ed., Mosby, 2011 (in press).

### FAQs

- May not be able to obtain cuff pressure (axial flow pump)
- Pump connected to electric line exiting patient's abdominal area and is attached to computer which runs the pump.
- Pump does not affect EKG
- All ACLS drugs may be given.
- No hand pump is available.
- A set of batteries last approximately 3 hours
- Any emergency mode of transportation is ok. These patients are permitted to fly.
- Be sure to bring ALL of the patient's equipment with them.

### TROUBLE SHOOTING: HeartMate II®

#### When the Pump Has Stopped

- Check the connections between the controller and the pump and the power source.
- Fix any loose connection (s) to restart the pump.
- If the pump does not restart and the patient is connected to batteries replace the current batteries with a new, fully-charged pair (see changing batteries section on next page)
- If pump does not restart, change controllers (see changing controllers section on next page)

#### Alarms: Emergency Procedures

**Yellow or Red Battery Alarm:** Need to Change Batteries. See changing batteries section on next page.

**Red Heart Flashing Alarm:** This may indicate a Low Flow Hazard. Check patient—the flow may be too low. If patient is hypovolemic, give volume. If patient is in right heart failure—treat per protocol. If the pump has stopped check connections, batteries and controllers as instructed in the section above.

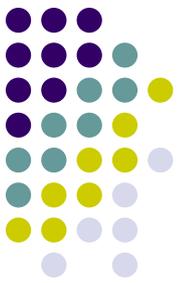


This guide does not supersede manufacturer instructions. Copy with permission only. March 2009

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# Future initiatives



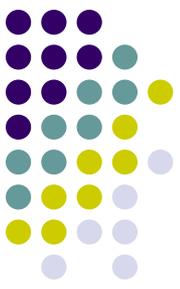


# Emergencies on VADs

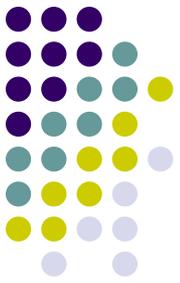
- Device related:
  - Power: Take extra batteries on transports
  - Controller: Bring back up controller
  - Pump: Each device has VAD parameter screens
- Patient related:
  - Arrhythmias: Shock as per ACLS
  - Volume: Give it
  - Bleeding: GI and CVA
  - Clotting: Pump hemolysis, embolic CVA



# What do VAD centers do to prepare patients for emergencies in the community



- Teach patients and their support system
- Notify power companies
- Notify and teach 1<sup>st</sup> due EMS
- Email Field guides



# Future

- Continue EMS training
- Involve Medical Directors
- Communicate with EMS providers:
  - Blackberry app
  - MCSO Web page
  - Conferences
  - On line resources (ex: Thoratec website)



