Cardiac Medicine Review Course Cardiomyopathies & Heart Failure

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Cardiomyopathy

- How can one name mean so many different things?
- One name Many causes
- Work in a group and write down as many cardiomyopathies that you can think of.

Cardiomyopathies

- Hypertrophic
- Stressed Induced (Takotsubo)
- Restrictive
- Dilated
- Idiopathic
- Valvular
- Genetic
- ▶ Ischemic
- Hypertensive
- Myocarditis (Infection/Inflammatory)
- Chemotherapy induced
- Periparium syndrome related to toxemia Cardiotoxic induced (effects of drugs or alcohol)

Cardiomyopathies

- Hypertrophic
- Dilated (ischemic and nonischemic)
- Stressed Induced (Takotsubo)
- Restrictive *

Hypertrophic Cardiomyopathy (HCM) Myocardial hypertrophy without the presence of associated hemodynamic stress (no 1 in afterload) Hypertrophy of the heart muscle including the septum and ventricular free wall Previously called IHSS -idiopathic hypertrophic subaortic sténosis Leading cause of death in athletics < 35 y/o



* Not on CMC test blue print

Hypertrophic Cardiomyopathy (HCM)

Pathophysiology



- 1. Hypertrophy of heart muscle including septum and ventricular free wall.
- 2. Rigid, noncompliant ventricles do not stretch
- 3. Causes diastolic dysfunction
- 4. \downarrow preload and cardiac output
- 5. Left atrial dilatation from inability to empty LA
- 6. Mitral regurgitation occurs from papillary muscles and mitral valve pulled out of alignment

Hypertrophy of LV, septum and ventricular wall, LA enlargement, MR



Hypertrophic Cardiomyopathy (HCM)

Causes

- Probably genetic
- May occur as early as the 1st year of life
- Develops most commonly during adolescence
- Hypertrophy manifests after age 20
- Diagnosis is usually made by age 25
- > Persons with normal echo and EKG after 25 y/o are unlikely to develop HCM

Hypertrophic Cardiomyopathy (HCM) Jugular venous **Clinical Presentation**

- Often diagnosed incidentally as may be asymptomatic
- Dyspnea on exertion · Chest pain on exertion -
- relieves with rest
- Syncope on exertion or rest Palpitations

- palpitation
- Associated with prominent
 "a" wave secondary to ↓ RV compliance
 Heart Sounds
- Arcarc SOUNDS
 Harsh systolic murmur LSB
 Murmur increases with movement
 S4 from LVH
 EKG

- Repolarization abnormalities
- Atrial enlargement (large p waves)
- Pathological Q waves -inferior leads

Sudden cardiac death often the first presentation





































Regurgitation

Causes	Treatment
 > 50% of IDC is familial > Suspected when other causes are excluded • CAD • Thyroid disease • Valvular abnormalities • Infiltrative causes • Hypertension • Alcohol 	 ACE inhibitors Beta blockers Anticoagulation is required due to the risk of thromboembolism Improvement of LV function is often better in IDC than in patients with IDM (ischemic dilated cardiomyopathy)



	Tursturset	Courses	True et au cont
Diagnosed when systolic function remains depressed despite adequate treatment of hypertension Myocardial systolic function is depressed out of proportion to the increase in wall stress	 Same as IDM (ischemic) Afterload reduction is the most important goal Antihypertensive vasodilators Amiodipine (Norvasc, besylate, mesylate or maleate) Alpha-blocking agents 	 Myocardial systolic function is depressed out of proportion to the increase in wall stress secondary to valvular abnormalities Most caused by left sided valves 	 Valve replacement or repair - improves wall stress but not depressed LVF ACEI & BB Aggressive afterload reduction Hydralazine Nitrates
	 Terazosin Tamsulosin (Flomax) 	 MR & AR AS less common cause 	 With AR- calcium channe blockers





37 y/o African American presents to ED with Shortness of Breath

- ▶ BP 152/102
- ▶ HR 100
- RR 28
- ▶ T 98.9 oral
- Sp0₂ 88% room air
- Loose cough
- Coarse rhonchi and scattered wheezes
- > 2+ pitting edema

PMH

- Asthma
- Pancreatitis
- Diabetes, type II (diet controlled)
- Smokes 4 cigarettes/day x 15 years
- Cocaine use in the past
- ightarrow Sister and daughter ightarrow sickle cell anemia

Labs

- ▶ WBC 8.2
- ▶ Hbg 10.2
- ▶ HCT 32.7
- Glucose 79
- Potassium 3.2
- Creatinine 1.2
- Troponin 0.06

Symptoms

- C/o not breathing "normally" with increased effort and shortness' of breath
- Moderate SOB at rest
- Decreased exercise capacity with exertional SOB
- Started two weeks ago and getting worse
- Albuterol treatment taken 1 hour ago at home

Adm	Admission EKG (37 y/o)			
COMMENT:				
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More history

- C-section two weeks ago for failure to progress
 4th child
- SOB and wheezing have become progressively worse since delivery
- Low grade fever past few days
- Productive cough

Admission Diagnosis

- Bilateral pneumonia vs CHF
- ? Peripartum cardiomyopathy
- Treatments
 - Albuterol/Atrovent nebs
 - Prednisone 50 mg po
 - Methylprednisolone 125 mg IV
 - Lasix 60 mg IV
 - Any concerns??
 Ceftriazone 1 gm IV
 - Azithromycin 500 mg IV
- Echocardiogram

Echo

- . LV mildly dilated
- EF 35%
- Mild to moderate aortic regurgitation
- Moderate mitral regurgitation
- RV mildly enlarged







Peripartum Cardiomyopathy (PPCM)

5th leading cause of mortality during the pregnancy period





Peripartum Cardiomyopathy (PPCM)

- Incidence per live births
 - 1:4350 USA- 10 years ago
 - 1:2399 USA 2011
 - \uparrow maternal age, \uparrow multifetal pg, \uparrow recognition PPCM • 1:1000 South Africa

 - 1:300 Haiti
 - 1:100 Nigeria
- Cause Unknown
- Usually occurs with first or second pregnancy

Source: Moser & Riegel-2009. Cardiac Nursing: Tsang, W, Peripartum Cardiomyopathy:.Retrieved 2:9-15 from Up To Date Sundin. C 2014. Peripartum Cardiomyopathy, MCN39(4)



- ▶ 30-40% increase in cardiac output by 2nd and 3rd trimester
- Changes may not resolve completely until 12 weeks postpartum

Source: Garg, J et al. 2045, Peripartum Cardiomyopathy. Cardiology in Review; 23(2).





PPCM symptoms

- Often missed or delayed
- Similar signs and symptoms of normal pregnancy

Comparison of Symptoms Preeclampsia Similar Symptoms PPCM Edema Dyspnea Proteinuria Couah Weight gain Headache Chest pain Tachycardia Blurred vision Palpitations Adventitious breath Decreased renal Third heart sound S3 sounds perfusion Jugular venous Hypertension Hyperactive DTRs distension Fatigue Tachypnea Murmur Impaired hepatic function Sundin. C 2014. Peripartum Cardiomyopathy. MCN 39(4)

Early Recognition is Key!

- For patients who develop
 - Dyspnea
 - Increasing blood pressure Increased edema or edema that doesn't decrease

 - Chest pain Tachycardia
 - Nonproductive cough
- Detailed, serial, frequent nursing assessments with accurate documentation
- Comprehensive and thorough communication with provider BNP, Echo
- Cardiology consult

PCCM Diagnosis

Three Clinical criteria

- 1. Development of HF end of pregnancy or first 5 months post delivery
- 2. Absence of other identifiable cause of HF
- 3. EF < 45%

PPCM Prognosis Related to the severity of cardiac dysfunction and return of ventricular function • Outcomes are better with peripartum than with other dilated cardiomyopathies ▶ 50% will recover completely Small minority will need transplant



Alcohol-Related Dilat	ed Cardiomyopathy
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Causes	Treatment
 Diagnosed when there is a history of sustained and heavy alcohol consumption and other causes of dilated cardiomyopathy are excluded. Toxic effects of alcohol are thought to cause the nonspecific changes in the myocardium Thiamine deficiencies can compromise cardiac function 	 Alcohol abstinence Same as for IDC (idiopathic) Prognosis is somewhat better than for IDC depending on the degree of myocardial impairment and alcohol abstinence









More history....

 A few hours earlier in the same ED, her husband came in full arrest and was not able to be resuscitated



Labs on admission

- ► CK = 156
- CKMB = 10.7 ↑
- Myoglobin = 298 ↑
- Troponin I = 2.91 ↑
- BNP = 35



Cardiac Cath findings

- Markedly depressed LV function with ejection fraction = 5 10%
- Severe hypokinesis to akinesis of the distal 2/3 anterolateral, apical, and inferior walls.
- The basal segments contract vigorously giving it very Japanese amphora shape suggestive of Takotsubo cardiomyopathy



Discharged the next day so she could attend her husband's funeral

- Discharge medications
- Aldactone 25 mg every day
- Alprazolam 0.5 mg prn
- Altace 2.5 mg every day
- ASA 81 mg every day
- Coreg 6.35 mg every 12 hours
- Coumadin 5 mg po every day
- Lasix 20 mg every other day
- Lipitor 40 mg po at hs

6 weeks later

- ▶ EF 60%
- Patient doing well







Original name given "Takotsubo Cardiomyopathy"

- Takotsubo is the narrow-necked bulging container used by Japanese fisherman to trap octopus
- The shape of the takotsubo pot resembles the distorted ballooning ventricle.
- Also called: Transient Left Ventricular Apical Ballooning



Etiology

- Unclear etiology
- ▶ 1 2% of patients who have S/S AMI have apical ballooning (Japan & USA)
- ▶ 6-9 times more common in women
- 6% of women with AMI have apical ballooning
- Most often in postmenopausal women

Takotsubo Cardiomyopathy

Pathophysiology

- Marked systolic ballooning of the ventricular apex
- Hypercontractility of the base of the heart
- Now thought to be related to stunning of the myocardium related to excessive catecholamines
- \bullet Since preceded by increased psychosocial or physical stress suggest an association with \uparrow SNS activity
- Catecholamines have a toxic effect on the myocardium

Catecholamine levels reported to be 7 - 34 times as high as the normal 2 - 3 elevation in classic AMI patients

Takotsubo Cardiomyopathy

Clinical Presentation

- Chest pain
- ST segment changes
- Cardiac biomarkers
- Only moderately elevated
 Do not follow the typical rise-fall-pattern seen with AMI
- 12 Lead EKG Variable
- findings • ST segment elevation or
- depression usually in the precordial leads (V2 - V5) Reciprocal changes in the
- inferior leads may not occur Q waves usually do not
- develop or Q waves V3 V6 Deeply inverted T waves are common in the recovery
- period Markedly prolonged QT interval







Left ventriculogram in systole (3a) and diastole (3b) to illustrate the ballooning 5-year-old woman was admitted to a local ED due to chest pain in the retrosternal region associated with severe dyspens. Before the onset of the symptoms, the patient reported a significant stress episode following a serious quarter with her husband.





Takotsubo Cardiomyopathy

Diagnosis

- Immediately difficult to differentiate between STEMI caused by thrombosis
- Suspect Takotsubo Cardiomyopathy when obstructive CAD is not present to explain the LV dysfunction
- Confirmation of diagnosis: typical octopus morphology of LV
- Stressor considered supportive evidence
- Complete resolution of LV dysfunction weeks after the event

Low EF - no CAD - precipitating stressor - octopus morphology



Takotsubo Cardiomyopathy

Prognosis

- Left ventricular function improves
 rapidly
- Often within 7 30 days
- EKG changes may be slower to resolve
- Generally favorable prognosis
- Mortality of 0 8%

LV function recovers



Restrictive Cardiomyopathy (RC)

Pathophysiology

- 1. Disease process causes noncompliant ventricles
- Noncompliant ventricles resist ventricular filling 2.
- \downarrow diastolic filling = \downarrow blood volume = \downarrow SV 3.
- Results in [↑] blood volume and pressure in atria 4. 5.
- Blood backs up into the lungs (left sided failure) and then in the venous circulation (righted sided failure)
- Disease process affects both ventricles 6
- Ventricular size usually normal or slightly decreased 7.
- Systolic function is not usually affected 8.

Heart becomes noncompliant and cannot stretch and fill









Arises from alterations in systolic and diastolic Systolic Dysfunction Diastolic Dysfunction Systolic and Diastolic Dysfunction are progressive syndromes that develop over the course of many Heart Failure preferred term Not all HF patients (especially those with diastolic dysfunction) exhibits symptoms of congestion HF is a progressive syndrome --- develops over many years



Acute HF	Chronic HF
 Also called:	 Denotes the slow
Decompensated HF New or worsening signs and	progression and
symptoms of the HF	continuance of the HF
syndrome Frequently leads to ED visits	syndrome Chronic HF patients
or hospitalization May also be: Sudden onset	frequently experience
of HF signs and symptoms	<i>"exacerbations of HF"</i> also
that occur in patients with	known as acute HF or
no previous HF history	decompensated HF



















Class	Patient Symptoms
Class I (Mild)	No limitation of physical activity. Ordinary physical activity does not cause undue fatigue, rapid/irregular heartbeat (palpitation) or shortness of breath (dyspnea).
Class II (Mild)	Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in fatigue, rapid/irregular heartbeat (palpitation) or shortness of breath (dyspnea).
Class III (Moderate)	Marked limitation of physical activity. Comfortable at rest, but less than ordinary activity causes fatigue, rapid/irregula heartbeat (palpitation) or shortness of breath (dyspnea).
Class IV (Severe)	Unable to carry out any physical activity without discomfort. Symptoms of fatigue, rapid/irregular heartbeat (palpitation) or shortness of breath (dyspnea) are present at rest. If any physical activity is undertaken, discomfort increases.

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HEART	FAILURE
Right-Sided Healt failure	1 Left sided Healt failure
- Dependent edema	-Disonea
-Jugular Venous distention	-Tachyoneg
-Abdominal distention	- crackles in the lunes
-Hepatomegaly	-Ory hacking cours
-Spienomegaly	-Parixysmal Nochinal dysprea
-Anorchia / Nauseg	(Think (mas!)
-Weight gain	-4
-Nocturnal divresis	
(Sullemir Esculution)	(-Quimman Sultern)

















NT proBNP (N-TERMINAL PRO-B)

Elevates with Heart Failure



- Not interchangeable with BNP
- proBNP is measured before it is metabolized into BNP (Hence proBNP)
- 5.1 ratio to BNP
- proBNP divided by 5 gives a number similar to the BNP values
- For example: pro BNP of 500/5 = 100
- proBNP < 450, probably not Heart Failure
- If age over 50, need to look at specific ranges
- 50 75 years proBNP > 900pg/mL consistent with HF > 75 years proBNP > 1800pg/mL consistent with HF



























Cardiogenic Shock Clinical Presentation Tachypnea Systolic BP < 90</p> Hypoxia Decreased sensorium → S3, S4 • Cool, pale, moist skin • Distended neck veins if Peripheral cyanosis right sided failure Crackles or Decreased urine output adventitious lung Tachycardia sounds if pulmonary • Weak, thready pulse edema Caused by massive insult to LV

Parameter	Normal Values
Cardiac Output (CO)	4 – 8 l/min
Cardiac Index (CI)	2.5 - 4.2 l/min/m ²
Right atrial pressure (CVP)	0 - 8 mmHg
Pulmonary artery pressure (PAS/PAD)	15 - 30/6 -12 mmHg
Pulmonary artery occlusive pressure	4 - 12 mmHg
Systemic vascular resistance (SVR)	770 - 1500 dyne/sec/cm ⁵
Pulmonary vascular resistance (PVR)	20 - 120 dyne/sec/cm ⁵
Stroke Volume (SV)	60 -130 mL/beat
Stroke Volume Index (SVI)	30 - 65 mL/beat/m ²
Arterial oxygenation saturation	95 - 100 %
Venous oxygenation saturation	60 - 80 %
Source: Sited in Cardiac Surgery Essen	ntials, page 148

	Hypovolemia	Fluid Overload	LV failure	RV failure	RV & LV failure	Sepsis
CO/CI						1
CVP						
PAD						
SV/SVI						
SVR/SVRI						
PVR/PVRI						







Cardiogenic Shock

Management

- Maximize oxygen to tissues
- Increase myocardial oxygen supply
- Decrease myocardial oxygen demand
- Improve contractility with supportive measures
- Mechanical support with IABP
- Left ventricular assist devices

	нсм	носм	Dilated	
Definition	Hypertrophy in < 25	Obstruction from hypertrophy	Enlarged dilated of one or all four chambers	
Symptoms	Syncope with exercise Harsh systolic murmur	Sudden cardiac death	Weakness Fatigue Decreased activity intolerance Systolic murmur S3	
LV Fx			Decreased EF Systolic dysfunction	
Treatment	Negative inotropes No aggressive exercise BB	Negative intropes No aggressive exercise BB SBE prophylaxis Myomectomy	Treat cause	

	Idiopathic	Ischemic	Hypertensive	Valvular
Definition	No underlying cause	CAD Most commone	From high BO	MR?AI
Symptoms	Same	Same		
LV Fx	Decreased EF Systolic dysfunction	Decreased EF Systolic dysfunction	Systolic dysfunction	Systolic dysfunction
Treatment	Same Anticoagulation	Same	Alpha blocking agents Vasodilators	Valvle repair/replacement Nitrates Hydralazine

	Peripartum	Alcohol Related	Restrictive	Takotsubo
Definition	Last trimester or up 6 months	From Alcohol	Decreased filling from noncompliant heart	Stressed induced Appears as AMI without CAD
Symptoms				EF very low and recovers within 6- 9 weeks
LV Fx	Systolic dysfunction	Systolic dysfunction	Normal EF	Ballooning of ventricle
Treatment	50% recover completely	Remove alcohol	Similar to diastolic	No fibrinolytics

	Systolic HF	Diastolic HF		
Definition	Inability to contract	Inability to fill		
ymptoms				
LV F	Decreased EF	EF normal		
Treatment	Treat HF symptoms ACEI, BB	Treat HF symptoms ACEI, BB		







VAD

- No pulse
- Anticoagulation needed
- Battery backup and Emergency plan





