



DILATED CARDIOMYOPATHY- WORK-UP

John Lynn Jefferies, MD

- Physical Examination
- Family history
- Chest X-ray
- ECG
- Echocardiogram (including relatives)
- Consideration of cardiac MRI with assessment of fibrosis
- Urine
 - organic acids including 3-methylglutaconic acid
 - urinalysis
 - amino acids
- Blood
 - lactic acid
 - pyruvate
 - serum electrolytes and markers of kidney function
 - glucose
 - Ca²⁺
 - Mg²⁺
 - selenium
 - CBC with differential
 - CPK (MM, MB, total)
 - Troponin
 - liver function studies
 - carnitine
 - acylcarnitine profile
 - cholesterol (fasting)
 - thyroid function studies
 - plasma for amino acids
 - ESR/CRP
 - viral serologies
- Skeletal muscle biopsy may be considered
 - histology
 - EM
 - mitochondrial respiratory chain analysis, acyl CoA DH analysis
- Endomyocardial biopsy
 - histology
 - EM
 - PCR for viral genome
 - mitochondrial respiratory chain analysis
- Genetic testing for non-acquired disease
- Consider genetics consultation if multi-organ systems involved

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DILATED CARDIOMYOPATHY: DIFFERENTIAL DIAGNOSIS BASED ON AGE

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< 1 YEAR OLD

1. Myocarditis
2. Endocardial Fibroelastosis Emery-Dreifuss Muscular Dystrophy (EFE)
3. Barth Syndrome
4. Carnitine Deficiency
5. Selenium Deficiency
6. Anomalous Left Coronary Artery from Pulmonary Artery (ALCA)
7. Kawasaki Disease (KD)
8. Critical Aortic Stenosis Case (AS)
9. Arterio-Venous Malformation (especially vein of Galen)
10. Calcium Deficiency

> 1 YEAR OLD < 10 YEAR OLD

1. Familial Dilated Cardiomyopathy (FDCM)
2. Barth Syndrome
3. Myocarditis
4. Arrhythmogenic Right Ventricular Dysplasia (ARVD)
5. Endocardial Fibroelastosis (EFE)
6. Carnitine Deficiency
7. Selenium Deficiency
8. Anomalous Left Coronary Artery from Pulmonary Artery (ALCA)
9. Kawasaki Disease (KD)
10. Toxic (Adriamycin)

> 10 YEAR OLD

1. Familial Dilated Cardiomyopathy
2. X-linked Dilated Cardiomyopathy (XLCM)
3. Myocarditis
4. Congenital Heart Disease (Ebstein's etc.) (CHD)
5. Post-operative Congenital Heart Disease
6. Mitochondrial Cardiomyopathy (P/O CHD)
7. Chagas Disease
8. Arrhythmogenic Right Ventricular Dysplasia (ARVD)
9. Eosinophilic Cardiomyopathy
10. Exposure Toxicity (e.g., chemotherapy)

DILATED CARDIOMYOPATHY: DIFFERENTIAL DIAGNOSIS BASED ON AGE (CONTINUATION)

< 1 YEAR OLD	> 1 YEAR OLD< 10 YEAR OLD	> 10 YEAR OLD
11. Hypoglycemia	11. -Ketothiolase Deficiency	11. Pheochromocytoma
12. Left Ventricular Noncompaction	12. Ipecac Toxicity	12. Duchenne Muscular Dystrophy Becker Muscular Dystrophy (DMD/BMD)
13. Mitochondrial Cardiomyopathy	13. Systemic Lupus Erythematosus	13. Emery-Dreifuss Muscular Dystrophy (EDMD)
14. Nemaline Myopathy	14. Polyarteritis Nodosa	14. Hemochromatosis
15. Minicore-Multicore Myopathy	15. Hemolytic-Uremic Syndrome	15. Umb-Girdle Muscular Dystrophy
16. Myotubular Myopathy	16. Mitochondrial Cardiomyopathy	16. Myotonic Dystrophy
17. Hypothyroidism	17. Nemaline Myopathy	17. Peripartum Cardiomyopathy
18. Incessant Tachycardia	18. Minicore-Multicore Myopathy	18. Alcoholic Cardiomyopathy
19. Electrolyte Disturbance	19. Myotubular Myopathy	19. Incessant Tachycardia
	20. Incessant Tachycardia	20. NM Disease NDJ
	21. Electrolyte Disturbance	21. Infiltrative Disease
		22. Nutritional Deficiencies
		23. Peripartum
		24. Endocrinopathies
		25. Electrolyte Disturbance

HCM-INITIAL WORK-UP
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- Echo
- ECG
- Urine
 - amino acids
 - organic acids
 - UA
- Skeletal muscle biopsy may be considered
 - histology
 - EM
 - mitochondrial respiratory chain analysis, acyl-CoA DH analysis
- Endomyocardial biopsy may be considered
 - histology
 - EM
 - mitochondrial respiratory chain analysis
- Blood for cell lines
 - FHCM mutation analysis
 - mitochondrial genome analysis
 - cytogenetics
- Blood for lactic acid, pyruvate, SMA-7, glucose, Ca²⁺, Mg²⁺, LFT's, carnitine, acylcarnitine, CBC with diff, cholesterol, plasma for amino acids
- Fibroblasts for acid maltase for Pompe's disease
- Family history
 - ECGs and Echo's of 1° relatives
 - prenatal Hx
 - * steroids
 - * placental insufficiency
 - * maternal diabetes mellitus
 - * other
- Genetic testing for sarcomeric disease
 - Additional genetic testing for mitochondrial disease of syndromic disease may be considered

DDX: HCM
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- Mitochondrial HCM
- Acyl-CoA dehydrogenase deficiency
- Pompe disease
- Noonan syndrome
- Sarcomeric protein abnormality
- IDM
- Other infiltrative disorders
 - Hurlers
 - Hunters
 - Sanfillipo
 - Other
- Beckwith-Wiedemann syndrome

CAUSES OF HYPERTROPHIC CARDIOMYOPATHY (HCM)

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Familial HCM (FHCM)

- Sarcomere Gene Mutations

METABOLIC

Carnitine Deficiency

Pompe Disease (Glycogen Storage Disease II) Forbes

Disease (Glycogen Storage Disease III) Phosphorylase

Kinase Deficiency (Glycogen Storage Disease IX)

DeBrancher Enzyme Deficiency

Selenium Deficiency Total Lipodystrophy Hurler Syndrome

Hurler-Scheie Syndrome

Hunter Syndrome

Fabry Syndrome (Glycolipid lipidosis)

Lysosomal Disorders (Danon's disease)

Mitochondrial Disease

I-Cell Disease

Glycosylation Disorders

Mannosidosis Fucosidosis, Type I

Infant of a Diabetic Mother (IDM)

Prenatal and Postnatal Steroid Exposure

HCM ASSOCIATED WITH SYNDROMES Noonan Syndrome

Cranio-Facial-Cutaneous Syndrome

Costello Syndrome

LEOPARD Syndrome

Friedreich's Ataxia

Beckwith-Wiedemann Syndrome

Mitochondrial Myopathy

•MELAS

•MERRF

•NADH-Coenzyme Q Reductase

Deficiency

•Histiocytoid Cardiomyopathy

(Cytochrome b Deficiency)

MISCELLANEOUS CAUSES

In Utero Ritodrine HCl Exposure

Swyer's Syndrome (46,XY Pure

Gonadal Dysgenesis)