Comprehensive Duchenne Care
Duchenne is not just a disease of the muscles. It affects every system in the human body.
Care Guides

• Duchenne Family Guide
  – Partnered with MDA, Treat-NMD, and WDO
  – Includes the Duchenne Care Considerations in an “easier to digest” format

• New Diagnosis and Early Care Guide
  – Introduction to Duchenne/Becker and genetic testing, adjusting to the diagnosis and support, early care, and introduction to clinical trials

• Imperatives for Healthcare Providers
  – One-page fact sheets for healthcare providers unfamiliar with Duchenne
  – Versions for pediatric and adult patients
  – Also available in Spanish

• Range of Motion Guide
  – Summary of current physical therapy guidelines for parents and physical therapists

#EndDuchenne
UPDATED!

EDUCATION MATTERS GUIDES FOR PARENTS & TEACHERS

www.parentprojectmd.org/classroom
Emergency Care Information

- **PPMD App**
  - Includes Duchenne emergency information
- **PPMD emergency information cards**
  - Also available in Spanish
- **PPMD large weatherproof emergency information cards for wheelchairs, scooters, and backpacks**
- **PJ Nicholoff Steroid Protocol**
  - Guide for families and healthcare providers to navigate steroid stress dosing, tapering, and what to do in the case of a missed dose
- **Online Resources**
  - Emergency care and hospital checklists
  - Caring for the Flu
  - Fracture management

#EndDuchenne
parentprojectmd.org/supportmaterials
Duchenne Expert Panel

**Pulmonary Care**
Jonathan Finder, MD  
*Le Bonheur Children’s Hospital*

**Cardiac Care**
Pradeep Mammen, MD  
*University of Texas Southwestern*

**Nutrition**
Kindann Fawcett, PhD  
*Arkansas Children’s Hospital*

**Behavior & Learning**
James Poysky, PhD  
*Katy Child Psychology Associates*

**Genetics**
Ann Martin, MS, CGC  
*Parent Project Muscular Dystrophy*
Preventing Respiratory Complications of Muscular Dystrophy

Jonathan D. Finder, MD
Professor of Pediatrics
University of Tennessee Health Science Center
Le Bonheur Children’s Hospital
When should you see a lung doctor?

- Generally by age 6 (know your resources)
- Annually until full time in a wheelchair
- More frequently in mid- and late-teens
- Measuring lung function
What is a lung function test?

- **Spirometry**: literally, measuring breath
  - **FVC**: forced vital capacity: how much air can you push out
  - **FEV1**: how much air can you push out within 1 sec

- **Pressures**: Maximal inspiratory and expiratory

- **SNIP**: nasal sniff inspiratory pressure

- **Exhaled carbon dioxide** (ETCO2)
1. Normal (age 0-10)
   • Vaccinate, educate
2. Inadequate cough (age 10-15)
3. Inadequate night time breathing (age 15-20)
4. Inadequate daytime breathing (>=age 17)
   • These ages vary greatly!
Stage 2: Inadequate cough

- Often asymptomatic until a respiratory tract infection
- Easily predicted with PFT’s and/or measurement of “peak cough flow”
- Peak cough flow <160 L/min associated with failure to extubate
- PEFR/PCF <270 L/m is indication for assisting cough


Manually assisting cough

Photo courtesy of Dr. John Bach
Preferred to direct tracheal suctioning in pts w/ tracheostomy (more effective, too)
Can be used via mask, mouthpiece, or tracheostomy
Achieves effective cough flows even in severely weak patients
Prophylactic use prevents atelectasis, supports chest wall compliance
Lung Volume Recruitment

- Use CoughAssist device to deeply inflate lungs
- Pops open areas of collapse within lungs
- Stretches the intercostal muscles
- Prevents having a stiff chest wall
- Keeps chest wall compliant
Supplemental O2 can be dangerous
Suppresses drive, can cause respiratory failure
Low saturation means increased airway clearance, need for increased ventilation
Pulse oximeter very helpful –but check CO2!
Obstructive Sleep Apnea

OSA: when breathing stops in sleep from upper airway obstruction/collapse
Diagnosed by SLEEP STUDY
Especially common in DMD:
- Large tongue
- Obesity from steroids
- Decreased muscle tone of upper airway
Treated with MASK therapy

- CPAP: constant positive airway pressure

Level of support is adjusted in sleep lab

Make sure device provided can later deliver BiPAP
Often predicted by lung function test
  - FVC < 30%

Signs include: A.M. headaches, Increasing awakenings, sleepiness, poor school performance, etc

Low sats on overnight oximetry

Retaining CO2 on sleep study
What is “BiPAP?”

- It’s a ventilator used via mask
- Bilevel pressure support
  - An inspiratory pressure to help support the size of the breath IN
  - An expiratory pressure to help keep the airway open
- It’s also a brand name (Respironics): VPAP is the same therapy (Resmed)
Note that FVC<30% in DMD correlates to ventilatory failure (but not in SMA).

Selected cohort FVC% and funct score pred of need for MV in DMD not SMA II (youngest pt 9 yrs)
Management of nocturnal hypoventilation

- Avoid tracheostomy, avoid oxygen
- BiPAP/VPAP or other positive pressure ventilator
- Avoid CPAP
  - Increases WOB w/o increasing ventilation
- Mask fit is essential!
- Sleep study to titrate (high-span)
Stage 4: 24 hour ventilation dependence

- No longer is tracheostomy required
- Most patients managed non-invasively
- Mouthpiece ventilator
- Newer, lightweight ventilators
  - Mounts to chair
  - Remaining in school or at work
Portable ventilator with a mouthpiece attached (like a microphone) to wheelchair

- Trilogy or LTV1150
- Tremendous improvement in energy level and quality of life
Patrick, age 26, graduating from Pitt Law, 2004
Pneumonia/atelectasis
Low oxygen level from CO2 retention
  Respiratory failure
Fat embolism syndrome after broken bone
THANKS FOR WATCHING!
DMD-Associated Cardiomyopathy: A Five Minute Overview

Pradeep P.A. Mammen, MD, FACC, FAHA, FHFS A
Associate Professor of Medicine
Co-Director: UTSW Wellstone Muscular Dystrophy Center
Medical Director: Neuromuscular Cardiomyopathy Clinic
Heart Failure, VAD & Heart Transplant Program
Division of Cardiology
UT Southwestern Medical Center
Duchenne Muscular Dystrophy
Clinical Manifestations of Duchenne Muscular Dystrophy

- Restrictive lung disease
- Nocturnal hypoventilation
- Scoliosis
- Fractures
- Progressive loss of muscle strength; wheelchair dependent by teen years
- Cognitive deficits
- Autism spectrum disorders
- Depression/anxiety
- Cardiomyopathy
- Arrhythmia
- Secondary mitral regurgitation
- Malnutrition
- Dysphagia
Development of DMD-Associated Cardiomyopathy
Life Expectancy in DMD Patients in 2021

Cumulative Survival

Age, yrs

Ashwath et al.
American J Cardiology 2014 114:284-289
Medical Management of Dystrophin-Associated Cardiomyopathy
Superior images, especially assessment of the RV.

Identification of myocardial fibrosis by presence of late gadolinium enhancement (LGE).

More accurate assessment of the RVEF (normal mean: 63%, range: 53-67%) and LVEF (normal mean: 67%, range: 62-72%).

Feingold et al. Circulation 2017
Birnkrant et al. Lancet Neurology 2018
2021 Heart Failure Management of DMD-Associated Cardiomyopathy

Treatment of heart failure in DMD:

* Beta-Blockers (Coreg, Toprol XL, Bisoprolol)
* ACEI vs. ARB
* Aldosterone Inhibitors (Spironolactone or Eplerenone)
* Steroids (Prednisone or Deflazacort)
* ARNI (Entresto: ARB + neprilysin inhibitor)
* SGLT2 Inhibitors (dapagliflozin or empagliflozin)
* Ivabradine (Corlanor)
* BiDil (or Isordil/Hydralazine)
* Diuretics (only if volume overloaded)
* Digoxin
* AICD vs. BiV/AICD
* LVAD and/or Cardiac Transplantation
# Guideline Directed Heart Failure Medications in DMD

## Use of Guideline Directed Heart Failure Medications

<table>
<thead>
<tr>
<th>Medication</th>
<th>Total (n=43)</th>
<th>Non-survivors (n=8)</th>
<th>Survivors (n=35)</th>
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<tbody>
<tr>
<td></td>
<td>Initial</td>
<td>End</td>
<td>Initial</td>
</tr>
<tr>
<td>Beta Blocker (%)</td>
<td>37</td>
<td>74</td>
<td>50</td>
</tr>
<tr>
<td>ACE-I or ARB (%)</td>
<td>86</td>
<td>98</td>
<td>88</td>
</tr>
<tr>
<td>Mineralocorticoid receptor antagonist (%)</td>
<td>7</td>
<td>47</td>
<td>13</td>
</tr>
</tbody>
</table>
UTSW Clinical Algorithm to Treating DMD-Associated Cardiomyopathy

Cardiac MRI: Preferred imaging tool to assess cardiac structure and function

- Normal LVEF, (-) LGE: ACEI (or ARB)
- Normal LVEF, (+) LGE: ACEI (or ARB) + Aldosterone Receptor Antagonist
- Abnormal LVEF, (-) LGE: Beta-Blocker + ACEI (or ARB)
- Abnormal LVEF, (+) LGE: Beta-Blocker + ACEI (or ARB) + Aldosterone Receptor Antagonist
UTSW Experience: Reverse Cardiac Remodeling in DMD Cardiomyopathy

- 2/75 patients expired in 10 years

UT Southwestern Medical Center
Cardiomyopathy in DMD Carriers
Cardiomyopathy in DMD Carriers

- Limited data on the clinical phenotype of DMD carriers.
- Heart failure in carriers is often unrecognized.
- DMD carriers can develop subclinical cardiomyopathy early in life without muscle weakness.
- DMD carriers develop symptoms related to heart failure (shortness of breath, fatigue, etc) much later in life.
# Cardiomyopathy in Female Carriers of Duchenne & Becker Muscular Dystrophies

<table>
<thead>
<tr>
<th></th>
<th>Sample Size</th>
<th>Normal Status</th>
<th>Pre-clinical Stage</th>
<th>Abnl Hrt with NI LVEF</th>
<th>Dilated CM</th>
<th>Total Cases of Abnl Hrts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DMD/BMD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Age: 5-15 y/o)</td>
<td>33</td>
<td>15 (46%)</td>
<td>13 (39%)</td>
<td>4 (12%)</td>
<td>1 (3%)</td>
<td>5 (15%)</td>
</tr>
<tr>
<td><strong>DMD/BMD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Age: &gt;15 y/o)</td>
<td>164</td>
<td>16 (10%)</td>
<td>75 (46%)</td>
<td>50 (31%)</td>
<td>18 (11%)</td>
<td>68 (45%)</td>
</tr>
</tbody>
</table>

Politano et al.  
*JAMA* 1996
Mechanism for Isolated Cardiomyopathy in DMD Carriers: Skewed X-Inactivation
Conclusions
Key Points: Take Home Messages

- All DMD patients (including carriers) require a full cardiac assessment, ideally by a CHF cardiologist.
- Cardiovascular complications in DMD patients are common.
  * Cardiomyopathy: Leading cause of death in DMD patients in 2021.
  * Arrhythmias.
- Cardiac MRI is the preferred imaging tool to accurately assess the cardiac structure and function of DMD patients.
Consider all adult DMD patients (including DMD carriers) as ACC/AHA Stage A patients.

Initiate ACEI early in DMD patients irrespective of LV function.

Initiate aldosterone inhibitors esp. if the cardiac MRI reveals late delayed enhancement.

Beta-blockers appear to improve cardiac function in dystrophin-associated cardiomyopathy.
UT Southwestern Wellstone Muscular Dystrophy Center
Virtual DMD/BMD Clinical Symposium

April 23, 2021 (Friday; 6pm to 9pm)
& April 24, 2021 (Saturday; 9am to 1pm)

Free Registration
R.S.V.P by April 21, 2021
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Chao Xing
Nutrition Considerations

Kindann Fawcett, PhD
Arkansas Children’s Hospital
Behavior & Learning

James Poysky, PhD

*Katy Child Psychology Associates*
Genetics,
Genetic Testing and
The Duchenne Registry

Ann Martin, MS, CGC
Certified Genetic Counselor
Roles of PPMD Genetic Counselors
FREE GENETIC TESTING AND COUNSELING FOR DUCHENNE AND BECKER MUSCULAR DYSTROPHY
Criteria for Free Testing:

- Male with a confirmed or suspected diagnosis of Duchenne or Becker, OR
- Female with a relative with Duchenne or Becker with a known mutation
- Never had genetic testing OR previous genetic testing has not confirmed a mutation
- Legal resident of US or Canada

All testing performed at:

[PerkinElmer]
THE STRENGTH OF THE REGISTRY IS YOU

Your data is critical in the fight to end Duchenne.
The Registry App!

THE DUCHENNE REGISTRY

The Duchenne Registry

The Duchenne Registry is an international, self-report registry and resource for individuals with Duchenne or Becker muscular dystrophy.

Join Study

Sign In

Available on the App Store

Android App on Google Play
Why YOU should join the Registry

1. Be a citizen scientist
2. Get specific information on clinical trials and drug approvals
3. Better understanding of EVERYONE with Duchenne/Becker/Carriers
Activation Code needed to join!

- Previous registrants already received invitation email w/ code.
- New registrants must first pre-register on our website.
Thank you!

coordinator@parentprojectmd.org

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