EDS & Pain

Norman Marcus, M.D.
Director, Norman Marcus Pain Institute
Clinical Associate Professor of Anesthesiology and Psychiatry
Director, Division of Muscle Pain Research
NYU School of Medicine
Six clinical types
Defective Metabolism of Collagen (Tenascin-X)

EDS Type III (Joint Hypermobility) and Classic Type represent 90% of all EDS cases.
Fragile and stretchy (hyperelastic) skin

Unstable and loose (hypermobile) joints

Fragile blood vessels and body tissues
Clinical Diagnosis

No genetic test
Common History with Joint Hypermobility

• Assets
  – Athletic activity/gymnastics
  – Dancing

• Liabilities
  – Joint instability
  – Pain
The majority of patients will at some point in adulthood begin to experience diffuse pain and subjective stiffness.
## Symptoms

### 79 patients (8 men, 71 women)

*Medication, Surgery, and Physiotherapy Among Patients With the Hypermobility Type of Ehler-Danlos Syndrome (Rombaut, et al, 2011)*

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint Pain</td>
<td>100%</td>
</tr>
<tr>
<td>Joint Dislocation</td>
<td>96.3%</td>
</tr>
<tr>
<td>Joint Lock</td>
<td>11.1%</td>
</tr>
<tr>
<td>Joint Swelling</td>
<td>3.7%</td>
</tr>
<tr>
<td>Muscular Pain</td>
<td>29.6%</td>
</tr>
<tr>
<td>Muscle Cramp</td>
<td>66.7%</td>
</tr>
<tr>
<td>Muscle Stiffness</td>
<td>7.4%</td>
</tr>
<tr>
<td>Muscle Weakness</td>
<td>14.8%</td>
</tr>
<tr>
<td>Tendinitis</td>
<td>25.9%</td>
</tr>
<tr>
<td>Headache</td>
<td>29.6%</td>
</tr>
<tr>
<td>Fatigue</td>
<td>25.9%</td>
</tr>
<tr>
<td>Bad physical condition</td>
<td>22.2%</td>
</tr>
<tr>
<td>Impaired Balance</td>
<td>3.7%</td>
</tr>
</tbody>
</table>

### 32 patients (all women)

*Musculoskeletal complaints, physical activity and health-related quality of life among patients with the Ehlers-Danlos syndrome hypermobility type (Rombaut, et al, 2010)*

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<thead>
<tr>
<th>Symptom</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>100%</td>
</tr>
<tr>
<td>Joint Problems</td>
<td>84.8%</td>
</tr>
<tr>
<td>Muscle Problems</td>
<td>64.6%</td>
</tr>
<tr>
<td>Skin Fragility</td>
<td>63.3%</td>
</tr>
<tr>
<td>Dysautonomia</td>
<td>58.2%</td>
</tr>
<tr>
<td>Fatigue</td>
<td>49.4%</td>
</tr>
<tr>
<td>Headache</td>
<td>36.7%</td>
</tr>
<tr>
<td>Neurologic Sxs</td>
<td>29.1%</td>
</tr>
<tr>
<td>Infections/Illnesses</td>
<td>27.8%</td>
</tr>
<tr>
<td>Cardiorespir. Sx</td>
<td>16.5%</td>
</tr>
<tr>
<td>Sleeping Problems</td>
<td>16.5%</td>
</tr>
<tr>
<td>Exercise Intol.</td>
<td>15.2%</td>
</tr>
<tr>
<td>Inflammation</td>
<td>15.2%</td>
</tr>
<tr>
<td>Cognitive Problems</td>
<td>10.1%</td>
</tr>
<tr>
<td>Logopedic Problem</td>
<td>7.6%</td>
</tr>
</tbody>
</table>
## Locations of Pain

<table>
<thead>
<tr>
<th>Location</th>
<th>Joint Pain (%)</th>
<th>Joint Dislocation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finger</td>
<td>59.4</td>
<td>44.4</td>
</tr>
<tr>
<td>Wrist</td>
<td>48.1</td>
<td>33.3</td>
</tr>
<tr>
<td>Elbow</td>
<td>14.8</td>
<td>14.8</td>
</tr>
<tr>
<td>Shoulder</td>
<td>85.2</td>
<td>63</td>
</tr>
<tr>
<td>Jaw</td>
<td>25.9</td>
<td>18.5</td>
</tr>
<tr>
<td>Neck</td>
<td>59.3</td>
<td></td>
</tr>
<tr>
<td>Back</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>Pelvis/Hip</td>
<td>66.7</td>
<td>48.1</td>
</tr>
<tr>
<td>Knee</td>
<td>81.5</td>
<td>40.7</td>
</tr>
<tr>
<td>Ankle &amp; Foot</td>
<td>77.8</td>
<td>51.9</td>
</tr>
<tr>
<td>Toe</td>
<td>11.1</td>
<td>3.7</td>
</tr>
</tbody>
</table>

Various Treatments

- Medication
  - NSAIDs
  - Opioids
  - Antidepressants
  - Sedatives/Benzos
  - Cardiovascular
  - Pulmonary
- Surgery
- Physiotherapy
  - Strength Training
  - Massage
  - Stabilization Training
  - Electrotherapy
  - Manual Therapy
  - Aquatic Therapy
  - Heat Therapy
  - Stretching
WHAT IS PAIN?

PAIN PRODUCING STIMULI

- Internal
  - Distension
  - Spasm
  - Inflammation

- External
  - Pricking, cutting, crushing,
  - Burning, freezing
What is pain?
Nociceptive/Pain Pathways
ACUTE PAIN

- Recent onset
- Usually in proportion to amount of tissue damage
ACUTE PAIN

- Patient appears in distress
- Increased heart rate
- Increased blood pressure
- Increased respiratory rate
- Increased sweating
- Dilated pupils
- Characterized as:
  Throbbing, Shooting, Sharp, Aching, Cutting, Stabbing, Twisting, Pulling, Tingling, Shooting, Squeezing, Burning
Behavior

Suffering

Pain

Sensation of Tissue Damage
Chronic Pain
May not appear in distress

Descriptors

• Killing
• Torturing
• Unbearable
• Too much to bear
• Overwhelming
• Consumes my life
• You can’t understand

• What did I do to deserve this?
• Why is G-d Punishing Me?
• I can’t go on living like this
• When will it end?
• I want to die
• Nobody can take this kind of pain
Life with Pain

- Sex
- Hobbies
- Family
- Friends
- Social Life
- Sports
- Work
- Pain
Life of Pain

Pain
Typical Pain Presentations in the General Population

- Low Back Pain
- Headache
- TMJ
- Neck and Shoulder
Why do patients with EDS have pain?
Pain Mechanisms

Musculoskeletal Pain

Psychosocial Factors
- Anxiety
- Pain-related fear

Physical Fitness
- Deconditioning
  - Muscle Weakness
  - Decreased cardiovascular Capacity

Biomechanical Factors
- Joint instability
  - Altered motor control
  - Connective tissue laxity: GJH
  - Nonphysiological motor patterns
  - Proprioceptive inacuity

Neurological Factors
- CNS upregulation
- Generalized hyperalgesia

Could painful muscles surrounding loose joints be a source of EDS related pain?
Tightened muscles stabilize loose joints.

Should muscles around the unstable joints therefore be considered as a significant source of pain in EDS?
Muscles and Blood Vessels

• Muscles and blood vessels
Muscles, Blood Vessels, and Nerves
Oxygen and Muscle Pain

Constricted blood vessels inhibit the flow of blood and deliver less oxygen:

Areas of lower oxygen cause Pain with activity

Impaired Calcium Pump/Inability to relax a part of a contracted muscle (Trigger Points)
Nerve entrapment often mistaken for pain from the spine
If muscles can be a common source of pain...

Why are they ignored?

Pathophysiology rarely studied
No discipline owns muscle
Properties of Muscle Nociceptors

Mechano-nociceptors, Chemo-nociceptors, Polymodal

- **Group III (A-delta) and IV (C) fibers**
- **Receptive free nerve ending activated by noxious (tissue-threatening, subjectively painful) stimuli. Useful in preventing as well as detecting tissue damage.**
- **High stimulation threshold**

How Muscles Hurt

• Specialized muscle nerves carry information telling us damage has, or is about to occur.

• Chemical or Mechanical = Polymodal Nociceptors

• Normally - High threshold to stimulate
Transmission of Peripheral Impulses into Dorsal Horn Neurons

Peripheral Sensitization

increased excitatory response to all stimuli

- Lowered mechanical threshold
- Tenderness and painful movement/allodynia
- Increased response magnitude to noxious stimuli
- Hyperalgesia

- Resting activity discharges
- Spontaneous pain
Sensitization

• What is it?
  – Picture of nerve with action potential
Peripheral Sensitization
increased response to all stimuli

Lowered mechanical threshold
tenderness and painful movement

Resting activity discharges
spontaneous pain
Central Sensitization (CS)

- Glutamate alone released affecting non-NMDA channels

- Following minutes of lasting or strong input from muscle nociceptors, SP also released (1st step in CS):
  - Opening of NMDA channels $\rightarrow$ persistent depolarization
  - Reduction of threshold to depolarize.

Central Sensitization  
(Pain causes more pain)  

Persistent peripheral nerve stimulation causes nerves in the spinal cord to be altered producing  

**muscle pain referral patterns**
Transmission of Peripheral Impulses into Dorsal Horn Neurons

Central Sensitization

Mechanisms of Muscle Pain Referral

• Opening of ineffective connections
  --> Existing closed pathways open up

• Convergence

• Heterosynaptic potentiation/Facilitation
Opening ineffective connections

Muscle Pain Referral
Heterosynaptic Facilitation
Convergence

- **Effective synapse**
- To thalamus
- Muscle B
- Muscle A
- Dorsal horn neuron
Glial Cells and Central Sensitization

Astrocytes and microglia produce pro-inflammatory cytokines when activated by peripheral pathological changes such as inflammation.

Central Sensitization: Glia

Peripheral mechanism of referred pain in a sciatic nerve injury model

- Mirror Pain @ Day 1
- Dorsal spinal cord Astrocyte activation @ Day 7 but no microglia activation

- ? Rx targets: rheumatoid arthritis, complex regional pain syndrome and neuropathic pain
Fig. 12 Possible mechanism underlying peripheral nerve injury-evoked mirror pain. Following spinal nerve ligation (SNL) on the right side, tumor necrosis factor α (TNF-α) is increased greatly in the ipsilateral (ipsi) dorsal root ganglion (DRG), diffuses t...
Diffuse Noxious Inhibitory Control (DNIC) Conditioned Pain Modulation (CPM)

Pain inhibits pain
Stronger pains conceal weaker pains

Review

- Muscle tissue is a source of pain:
  - Acute
  - Chronic
  - Referred
Hans Kraus, M.D.

Functional Muscle Pain

- Tension
- Deficiency: Weakness and/or Stiffness
- Spasm
- Trigger Points
Muscle Tension

VOLUNTARY, SUSTAINED CONTRACTION OF STRIATED MUSCLE.

Examples:

- LBP
- TMJ Dysfunction
- Non-specific Neck and Shoulder Pain
Diagnosis of Tension

**HISTORY** of sustained overuse of muscle groups

**PHYSICAL EXAM** which reveals a failure to voluntarily relax
Can sustained feeling states produce prolonged contraction of specific muscle groups and subsequent pain patterns?
Hans Kraus, M.D.
Functional Muscle Pain

• Tension
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• Spasm
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The Y’s Way to a Healthy Back

- Taught to 300,000 patients – twice a week for six weeks
- 12K patients studied: 80% of patients experienced reduction and/or elimination in back pain
- Patients with previous back surgery had an 82% success rate

Kraus/Marcus Lower Body Exercises (Level 1)

Diaphragmatic Breathing

Shoulder Shrugs

Leg Slides

Head Rotations

Single Knee to Chest

Side Lying Knee to Chest

Buttocks Squeeze
Hans Kraus, M.D.

Functional Muscle Pain

- Tension
- Deficiency: Weakness and/or Stiffness
- Spasm
- Trigger Points
Pain-Spasm-Pain Concept

- Spinothalamic tract
- III-IV
- α-Motor fiber
Pain and Spasm

• The muscle in spasm is frequently not the muscle causing your pain.

• Lund hypothesis - The injured or painful muscle has less activity. The antagonist (muscle opposing the injured muscle) has more activity and often spasm.
Agonist/Antagonist
Summary of Neuronal Input to Dorsal and Ventral Horn
Hans Kraus, M.D.

Functional Muscle Pain

- Tension
- Deficiency: Weakness and/or Stiffness
- Spasm
- Trigger Points
MTrPs Theoretical Model
Myofascial Trigger Points

- Tender nodular area in muscle
- Taut band
- May refer to proximal and distal muscle
- SP, CGRP, BKN, 5-HT, Cytokines (Shah, J)
- Hypoxia and acid pH

- *Diagnosis made by pain to palpation*
Validity of MTrP Protocols?


Palpation/Pressure

- Unreliable
- Sedentary muscle vs. Active muscle
- Misses nociceptors in the muscle attachment sites
- Primary Muscle/Referred Pain?
Muscle Stimulation Hypothesis

Postulate:
Externally induced contraction

Stimulates nociceptors in the attachments (entheses)

Deforms sensitized muscle tissue (trigger points)
Painful Muscle Detection Instrument
25 year old man with 5 year history of Low Back Pain, Neck Pain, Headaches
Muscle Pain Referral
Post-MTI to Right Infraspinatus
A Novel Structured Muscle Algorithm to Diagnose and Treat Pain of Muscular Origin May Successfully and Reliably Decrease or Eliminate Pain in a Chronic Pain Population

- **176 patients**
  - 133 (76%) identified with muscle pain
  - 70 patients eligible for treatment
  - 45 started and finished treatment

Initial 4.95/5.00
Post 2.02/1.25
p<.001

1 month 1.87/1.13
p=1.0

Avg decrease 62%
Med decrease 70%
Initial 5.28/5.67
Post 1.32/0.71
p < .001

1 month 1.57/0.57
p = 0.49

Avg decrease 68%
Med decrease 85%
67/95 patients S/P FBSS, RFA, ESI, TPI/Prolotherapy
Pre/Post MTIs (77 weeks F/U)

Mean Severity and Interference Over Time (at 77 weeks)
Step-care pain treatment

- Most likely contributing diagnoses
- Least harmful interventions
- Most cost-effective
Outside the Box

- FBSS
- HNP
- DDD
- FMS
- Spinal Stenosis
- Facet disease
- RSD
- Sacroiliac dysfunction
- Rotator cuff tear/Impingement syndrome
- Pelvic pain
- Headaches
- EDS
Case 1/ Pain onset age 20

Joint hypermobility
9/9 Beighton Scale

Diagnoses:

• Facet arthropathy/RFA’a
• Low Back Pain
• Migraine Headaches
• Headaches of unknown origin

• Shoulder Pain
• Thigh Pain
• Shin Splints
• IBS
Case 2

- FBS – onset age 10, initially pain in legs
- Total body pain, wheelchair x 2 years
- Elevated CSF pressure
- Autonomic dysfunction (hypertension)
- Began Treatment for Muscle Pain age 23
Case 3

- Multiple Joint Replacements (Severe pain post op caused CHF)
- Recurrent Dislocations
- Severe pain and spasm around unstable joints
- Injections relieved pain but caused increased dislocations
Low Level Laser Therapy

Non-visible spectrum with sufficient energy to penetrate deep tissue.
- Growth Factor production
- Cell proliferation
- Extracellular Matrix Deposition
- Cell mobility / adhesion
- Inhibition of apoptosis
Foundation for Research and Advocacy for Muscle Pain Evaluation and Treatment (FRAME)

• Laser treatments in EDS Type III (jt. hypermobility type)
• 10 patients (1 male, 9 female)
• 5 sessions
Results

Length of Pain Relief

Pain Relief at End of Rx

Pain Relief S/P 1 Month
For more information please visit:

www.nmpi.com
Chronic Painful Work-Related Muscle Syndromes

- Repetitive muscle use
- Sustained uncoordinated contraction
- Time pressure*
- Psychic Stress*
- Cinderella syndrome**

*Hughes L et al, Effects of psychosocial and individual factors on physiological risk factors for upper extremity musculoskeletal disorders Ergonomics 2007, V50, 2:261-274

**Kadefors R et al, Recruitment of low threshold motor units in the trapezius muscle in different static arm positions Ergonomics 1999, V42, 2:359-375