



Michigan Medicine Laboratories
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Ann Arbor, MI 48109
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Last Name: SMITH
First Name: JOHN
MRN: XXXX002121754
Sex: Male **Age:** 52 YR **DOB:** 1/1/1967
Physician: JONES, JOHN
Location: EAST HOSPITAL

SURGICAL PATHOLOGY REPORT

UM Order Number: SU-20-88918

Date Collected: 03/3/2020
Date Received: 03/4/2020 11:02 AM
Date Completed: 03/05/2020 4:39 PM

Diagnosis

A-C. Skeletal muscle, left quadriceps, biopsy (EAST HOSPITAL)
Severe chronic and active neurogenic changes (see comment).

Signing Pathologist: Sean Ferris, M.D., Ph.D.

Comment:

This biopsy demonstrates small and large (entire fascicle) groups of atrophic fibers that are a mixture of type 1 and type 2 fibers, frequent subsarcolemmal nuclear aggregates, frequent target fibers, and frequent esterase-positive small atrophic fibers. These are features of an active neurogenic process. The presence of endomysial fibrosis and frequent fiber type grouping (chronic neurogenic rearrangement) indicate a significant component of chronicity. Together these findings support the diagnosis of severe chronic and active neurogenic changes.

The finding of severe neurogenic changes is non-specific as to etiology, but could be due to damage anywhere along the neuraxis, including motor neuron and peripheral nerve. The combination of active and neurogenic changes, the severity of the neurogenic atrophy and the presence of whole fascicular atrophy in this case could be seen in a motor neuron disease such as amyotrophic lateral sclerosis (ALS), but some additional etiological considerations include back injury, spinal or vertebral surgery, disc, spondylolisthesis, vertebral misalignment, radiculopathy, diabetes, polyneuropathy, or mononeuropathy. Correlation with clinical history, EMG/NCS results, and neurologic exam findings could help determine an etiology for these neurogenic changes.

Microscopic Description:

Formalin-fixed, paraffin-embedded H&E: Hematoxylin- and eosin-stained sections of the paraffin-embedded tissue show marked variation in muscle fiber diameters, with frequent small and large groups of mostly angulated atrophic fibers and adjacent fibers with compensatory hypertrophy. Frequent subsarcolemmal nuclear aggregates are seen. There are no degenerating/regenerating muscle fibers. There is moderate endomysial fibrosis in areas of atrophy. There is a moderate amount of infiltrating fat. There is no endomysial inflammatory infiltrate. The epimysial and perimysial vessels show no perivascular inflammation and no vasculitis. Central nuclei are not increased.

Frozen H&E: Hematoxylin- and eosin-stained sections of the frozen section material show similar findings to the paraffin-embedded tissue with frequent small groups of atrophic fibers, hypertrophic fibers, frequent subsarcolemmal nuclear aggregates, and moderate endomysial fibrosis in areas of atrophy. There is no inflammation, no

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degenerating/regenerating muscle fibers, and no increase in central nuclei. The atrophic muscle fiber diameters range from 5 - 25 microns, and diameters range from 100-130 microns in the hypertrophic fibers, with only a minor population of muscle fibers with diameters between these ranges.

Frozen Trichrome: Trichrome staining shows moderate endomysial fibrosis in areas of atrophy, no ragged red fibers, no rimmed vacuoles, and no nemaline rods.

Frozen Slow Myosin (S-MYOS) and Frozen Fast Myosin (MYOSF): Immunohistochemistry for slow myosin shows the muscle fiber type distribution to be approximately 80% slow-myosin-expressing, with frequent type 1 groups. Immunohistochemistry for fast myosins shows the muscle fiber type distribution to be approximately 70% fast-myosin-expressing, with frequent type 2 groups. Up to 50% of the fibers are hybrid fibers that express both myosin proteins. There are frequent small groups of atrophic fibers composed of both type 1 and type 2 fibers.

Frozen ATPase pH 4.6 and Frozen ATPase pH 9.4: ATPase pH 4.6 staining shows the muscle fiber type distribution to be approximately 50% type 1 fibers (dark staining) and 50% type 2 fibers (light staining), with frequent type 1 groups and frequent type 2 groups. ATPase pH 9.4 staining shows the muscle fiber type distribution to be approximately 50% type 1 fibers (light staining) and 50% type 2 fibers (dark staining), with frequent type 1 groups and frequent type 2 groups. Some fascicles are more type 1 predominant and other fascicles are more type 2 predominant. Additionally, the groups of atrophic fibers contain fibers of both fiber types.

Frozen Toluidine blue: Non-contributory.

Frozen NADH: NADH staining shows frequent target fibers, no moth-eaten fibers, no fibers with scalloping of the myofibrillary matrix, and no fibers with subsarcolemmal crescents.

Frozen SDH: SDH staining shows frequent target fibers, an expected pattern of mitochondrial distribution within the muscle fiber types, and scattered fibers showing subsarcolemmal mitochondrial aggregates.

Frozen COX/SDH: COX/SDH staining shows no increase in COX-negative fibers. There is an expected pattern of distribution of mitochondria within type 1 and type 2 muscle fibers.

Frozen Non-specific esterase (ANAE): Demonstrates frequent esterase-positive small angulated fibers.

Frozen Alkaline Phosphatase: There is no increase in perimysial staining. In addition, alkaline phosphatase stains perifascicular end-arterioles (positive internal control).

Frozen PAS: PAS staining shows no increase in glycogen deposition.

Frozen Oil Red O: Oil Red O staining shows no fibers with increased lipid deposition.

Frozen Laminin: Demonstrates intact sarcoplasmic staining on muscle fibers.

Frozen Congo Red: There is no increase in congophilic material.

History:

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This is a 52-year-old man with muscle wasting. He has a history of constant dull achy pain in the thoracic spine since 1994. He has neck stiffness and numbness and tingling in both feet and legs for 2-4 months. MRI shows degenerative disc disease and spondylosis and facet arthrosis.

Source of Specimen: Left quadriceps biopsy.

Gross Description:

A. "Left quadriceps" Received in formalin in a small container is a 1.5 x 1.1 x 0.6 cm skeletal muscle segment. Sectioned for cross and longitudinal sections.

A1. Cross sections. (2ns)

A2. Longitudinal sections. (2ns)

B. "Left quadriceps biopsy" Received frozen tissue, 1.9 x 0.8 x 0.3 cm for muscle histochemistry. Specimen had to be refrozen due to freezing artifact.

IPOX

C. "Left quadriceps" Received in glutaraldehyde is a 1.5 x 1 x 0.7 cm skeletal muscle fragment. Specimen placed on hold in the EM lab.

MCG

Electronically Signed By:

Sean Ferris, M.D., Ph.D.

I, the above named pathologist, have personally examined and interpreted the slides from this case.

House Officer(s):

Kyle Conway

CPT Codes:

Specimen	CPT Code	Number of Charges
A, B	88305	2
B	88314	5
B	88319	7
B	88341	2
B	88342	1

Laboratory Accrediting Agency Compliance Statement:

If immunostain testing was performed on this case, the testing was developed and the performance characteristics were determined by the University of Michigan Clinical Immunoperoxidase Laboratory. It has not been cleared or approved by the U.S. Food and Drug Administration. (The FDA has determined that such clearance is not necessary. This test is used for clinical purposes. It should not be regarded as investigational or for research.) Appropriate negative and positive controls were run and demonstrated expected results. Most antibodies (including ER, PR, and HER2/neu) were not validated on decalcified tissues; negative staining on decalcified specimens should therefore be viewed with discretion, as a falsely negative result cannot be excluded. The Coreo ACIS instrument (if used for any test on this case) is FDA approved.

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Performing site:

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