See below for Additional Technical Information topics

**3-Hydroxy-3-Methylglutaryl Coenzyme A Reductase Antibody, IgG**

**Idiopathic Inflammatory Myopathies (Myositis)**

### 3-Hydroxy-3-Methylglutaryl Coenzyme A Reductase Antibody, IgG

#### Indications for Ordering

- Differential diagnosis of myositis in patients with or without statin exposure
- Monitor response to treatment

#### Test Description

Semiquantitative enzyme-linked immunosorbent assay

#### Tests to Consider

**Primary test**

**3-Hydroxy-3-Methylglutaryl Coenzyme A Reductase (HMGCR) Antibody, IgG 2013101**

- Detects IgG autoantibodies against HMGCR
- In addition to clinical evaluation for muscle strength and serum creatine kinase, may be useful to monitor response to treatment

**Related tests**

- **Creatine Kinase, Total, Serum or Plasma 0020010**
  - Nonspecific indicator of muscle inflammation or damage
  - Monitor therapeutic response

- **Extended Myositis Panel 3001781**
  - May be useful for differential evaluation of polymyositis, dermatomyositis, necrotizing autoimmune myopathy, or overlap syndromes associated with connective tissue disease

- **Polymyositis and Dermatomyositis Panel 2013992**
  - May be useful for evaluation of patients with progressive proximal muscle weakness and/or with cutaneous manifestations suggestive of dermatomyositis and/or associated connective tissue disease

- **Antinuclear Antibody (ANA) with HEP-2 Substrate, IgG by IFA with Reflex by Pattern 3000601**
  - Initial screen for autoimmune connective tissue diseases

- **Connective Tissue Diseases Profile 0051668**
  - Confirmatory tests for specific connective tissue disease

#### Disease Overview

**Age of onset** – 30-70 years

**Most common clinical features**

- Persistent and progressive proximal weakness
- Myalgia
- Elevated serum creatine kinase concentration
  - \( > 10,000 \text{ IU/L} \) mean concentration prior to treatment
  - Range – 950-45,000 IU/L

**Physiology**

- Presence of anti-HMGCR antibodies is associated with a rare form of idiopathic inflammatory myopathy referred to as necrotizing autoimmune myopathy
- Anti-HMGCR IgG antibodies are mainly associated with exposure to statins
  - Also occur in statin-naïve patients with myositis
- Muscle biopsy is associated with
  - Abundant necrotic fibers
  - Sparse lymphocytic infiltrate
  - Complement deposits on capillaries
  - Increased expression of major histocompatibility complex class 1 molecules
- In most patients, statin-induced myopathy resolves within months after discontinuation of treatment
  - Minority develop a progressive necrotizing myopathy associated with anti-HMGCR antibodies
    - Requires immunosuppressive therapy
  - Response to treatment is associated with
    - Decline in antibody titers and creatine concentration
    - Improvement in muscle strength
**Sensitivity/specificity**
- Analytical sensitivity – 94.4% (Hamann, 2013)
- Analytical specificity – 99.3% (Hamann, 2013)

**Results**
- Positive – ≥20 units
- Negative – <20 units

**Limitations**
- Diagnostic relevance in a minor subset of patients with inflammatory myopathy
- Results should be used in conjunction with clinical findings, muscle biopsy, and other relevant laboratory tests for disease evaluation
- Negative results do not rule out inflammatory myopathy, necrotizing autoimmune myopathy, or statin-associated myopathy

**References**

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**Idiopathic Inflammatory Myopathies (Myositis)**

**Indications for Ordering**
Differential diagnosis of inflammatory myopathies in conjunction with muscle biopsy and clinical presentation

**Test Description**

**Polymyositis and Dermatomyositis Panel**
- Qualitative immunoprecipitation/semiquantitative multiplex bead assay/qualitative immunoblot

**Extended Myositis Panel**
- Qualitative immunoprecipitation/semiquantitative multiplex bead assay/qualitative immunoblot

**Polymyositis Panel**
- Qualitative immunoprecipitation/semiquantitative multiplex bead assay

**Dermatomyositis Panel**
- Qualitative immunoprecipitation/qualitative immunoblot

**Interstitial Lung Disease Panel**
- Qualitative immunoprecipitation/semiquantitative multiplex bead assay/qualitative immunoblot/semiquantitative enzyme-linked immunosorbent assay/quantitative immunoturbidimetry

**3-Hydroxy-3-Methylglutaryl Coenzyme A Reductase (HMGCR) Antibody, IgG**
- Semiquantitative enzyme-linked immunosorbent assay

**Tests to Consider**

**Typical testing strategy**
Initial screening tests
- Creatine kinase
- Erythrocyte sedimentation rate/C-reactive protein
- Thyroid-stimulating hormone: rule out thyroid disease as etiology for myopathy
- Metabolic profile
- Complete blood count
- Antinuclear antibodies

Antibody testing (minimum recommended)
- Antisynthetase antibodies: anti-Jo-1, anti-PL-7, anti-PL-12, anti-EJ, anti-OJ
- Nonsynthetase antibodies: anti-Mi2, anti-p155/140, anti-SRP
- Myositis associated antibodies: anti-PM/ScI-100, anti-SSA(RO), anti-U1 RNP

Definitive diagnosis
- Muscle biopsy (which can be guided by MRI) is gold standard

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Primary tests

Dermatomyositis and Polymyositis Panel 3001783
- May be useful for evaluation of patients with progressive proximal muscle weakness and/or with cutaneous manifestations suggestive of dermatomyositis and/or associated connective tissue disease
- Components
  - Jo-1 antibody, IgG
  - PL-7 (threonyl-tRNA synthetase) antibody
  - PL-12 (alanyl-tRNA synthetase) antibody
  - EJ (glycyl-tRNA synthetase) antibody
  - SRP (signal recognition particle) antibody
  - OJ (isoleucyl-tRNA synthetase) antibody
  - Mi-2 (nuclear helicase protein) antibody
  - P155/140 antibody
  - SAE1 (SUMO activating enzyme) antibody
  - MDA5 (CADM-140) antibody
  - NXP-2 (nuclear matrix protein-2) antibody
  - TIF1-gamma (TIF1-y) antibody

Extended Myositis Panel 3001781
- May be useful for differential evaluation of polymyositis, dermatomyositis, necrotizing autoimmune myopathy, or overlap syndromes associated with connective tissue disease
- Components
  - SSA 52 and 60 (Ro) (ENA) antibodies, IgG
  - SM/RNP (ribonucleic protein) (ENA) antibody, IgG
  - Jo-1 antibody, IgG
  - Mi-2 (nuclear helicase protein) antibody
  - PL-7 (threonyl-tRNA synthetase) antibody
  - PL-12 (alanyl-tRNA synthetase) antibody
  - P155/140 (TIF1-gamma) antibody
  - EJ (glycyl-tRNA synthetase) antibody
  - Ku antibody
  - SRP (signal recognition particle) antibody
  - OJ (isoleucyl-tRNA synthetase) antibody
  - SAE1 (SUMO activating enzyme) antibody
  - MDA5 (CADM-140) antibody
  - NXP-2 (nuclear matrix protein-2) antibody
  - TIF1-gamma (TIF1-y) antibody
  - Fibrillarin (U3 RNP) antibody, IgG
  - PM/Scl-100 antibody, IgG by Immunoblot

Polymyositis Panel 2013990
- May be useful for evaluation of patients with progressive proximal muscle weakness and antisynthetase syndrome
- Components
  - Jo-1 antibody, IgG
  - PL-7 (threonyl-tRNA synthetase) antibody
  - PL-12 (alanyl-tRNA synthetase) antibody
  - EJ (glycyl-tRNA synthetase) antibody
  - SRP (signal recognition particle) antibody
  - OJ (isoleucyl-tRNA synthetase) antibody

Dermatomyositis Autoantibody Panel 3001782
- May be useful for evaluation of patients with characteristic cutaneous manifestations of dermatomyositis with or without muscle weakness
- Components
  - Mi-2 (nuclear helicase protein) antibody
  - P155/140 (TIF1-gamma) antibody
  - SAE1 (SUMO activating enzyme) antibody
  - MDA5 (CADM-140) antibody
  - NXP-2 (nuclear matrix protein-2) antibody
  - TIF1-gamma antibody

Interstitial Lung Disease Autoantibody Panel 3001784
- May be useful for evaluation of interstitial lung disease in the context of connective tissue disease
- Components
  - SSA 52 and 60 (Ro) (ENA) antibodies, IgG
  - Scleroderma (Scl-70) (ENA) antibody
  - Jo-1 antibody, IgG
  - PL-7 (threonyl-tRNA synthetase) antibody
  - PL-12 (alanyl-tRNA synthetase) antibody
  - EJ (glycyl-tRNA synthetase) antibody
  - Ku antibody
  - SRP (signal recognition particle) antibody
  - OJ (isoleucyl-tRNA synthetase) antibody
  - PM/Scl-100 antibody, IgG by immunoblot
  - MDA5 (CADM-140) antibody
  - NXP-2 (nuclear matrix protein-2 Ab)
  - Rheumatoid factor
  - Cyclic citrullinated peptide (CCP) antibody, IgG
  - Nuclear antibody (ANA) by IFA, IgG

3-Hydroxy-3-Methylglutaryl Coenzyme A Reductase (HMGCR) Antibody, IgG 2013101
- Differential diagnosis of myositis in patients with or without statin exposure
- In addition to clinical evaluation for muscle strength and serum creatine kinase, may be useful to monitor response to treatment

Related tests
- Creatine Kinase, Total, Serum or Plasma 0020010
- Antinuclear Antibodies (ANA), IgG by ELISA with Reflex to ANA, HEp-2 Substrate, IgG by IFA 0050080
- SSA 52 and 60 (Ro) (ENA) Antibodies, IgG 2012074
- Jo-1 Antibody, IgG 0099592
- Smith/RNP (ENA) Antibody, IgG 0050470
- Signal Recognition Particle (SRP) Antibody 2002098
- PM/Scl-100 Antibody, IgG by Immunoblot 2003040
- Fibrillarin (U3 RNP) Antibody, IgG 2012173

Disease Overview

Incidence: 4-10/million adults; rare in children

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**Age of onset:** varies by disorder

- Dermatomyositis (DM)
  - Bimodal: childhood and 50-70 years
- Polymyositis (PM): rare in childhood, typically >20 years
- Inclusion body myositis (IBM): >50 years
- Necrotizing autoimmune myositis: primarily adults, often older

**Syndromes**

- DM: associated with cancer
- PM
- IBM
- Necrotizing autoimmune myositis
- Overlap syndrome
- Juvenile DM and PM

**Symptoms**

**General features**

- Musculoskeletal: progressive muscle weakness (usually symmetrical and proximal)
  - Pharyngeal and neck flexion muscles frequently involved
- Arthralgias/arthritis: wrists, knees, small joints of hands
- Constitutional: fever, weight loss
- Pulmonary: fibrosing alveolitis, aspiration pneumonia
- Gastrointestinal: esophageal dysfunction, dysphagia
- Cardiovascular: myo-/pericarditis, valvular disease, rhythm disturbances
- Renal: rarely myoglobinuria, glomerulonephritis
- Dermatologic: Raynaud phenomenon, rashes, calcinosis over bony prominences

**Antisynthetase syndrome**

- Found almost exclusively in middle-aged women with DM or PM
- Characterized by
  - Low-grade fevers
  - Interstitial pneumonitis: major determinant of morbidity and mortality
  - Hyperkeratosis, cracking of lateral and palmar aspects of the fingers (mechanic’s hands)
  - Raynaud phenomenon
  - Inflammatory polyarthritis, myalgias
- Presence of antinuclear antibodies known as antisynthetases

**DM**

- Characteristic photosensitive rash accompanied by symmetrical, subacute, proximal muscle weakness
  - Rash usually precedes muscle symptoms
  - Blue-purple rash – symmetrical distribution
  - Violaceous discoloration of upper eyelids with periorbital edema (heliotrope rash)
  - Erythema of metacarpophalangeal proximal and distal joints
  - Raised violaceous rash (Gottron sign) or scaly erythematous plaques over dorsal surface of bony prominences (Gottron papules): considered pathognomonic for DM
  - Macular erythema over the lower neck and upper chest in a V-distribution (V-sign), over upper back (Shawl sign), or over upper thighs (Holster sign)
  - Telangiectasias at base of fingernails, cuticular overgrowth and periungual erythema
  - Vasculitic skin changes
    - Subcutaneous nodules, periungual infarcts, digital ulcerations
- Cancer-associated myositis
  - Most commonly associated with DM, but can be found in PM
  - May be diagnosed prior to, simultaneously with, or after myopathy
  - Increased risk of malignancy (20-25%) of any of the following types (highest risk in first 2-3 years after diagnosis)
    - Ovarian
    - Breast
    - Melanoma
    - Colorectal
    - Non-Hodgkin lymphoma
- Amyopathic DM
  - Characteristic cutaneous findings of DM >6 months without muscle involvement
  - May progress to DM
  - Some risk for lung disease, malignancy
  - Electromyography may demonstrate subtle myopathy

**PM**

- Dominated by muscular presentation
  - No rash
- Usually subacute presentation
- May be associated with other autoimmune diseases
- Diagnosis of exclusion: must rule out the following
  - Neuromuscular disease
  - Endocrinopathy
  - Muscular dystrophy
  - Known biochemical muscle disorder or familial biochemical disorder
  - Drug-induced myopathy

**IBM**

- Two types: sporadic, hereditary
- Muscle involvement
  - Muscle atrophy early in disease
  - Distal weakness is most common: deep finger flexors and foot extensors common
  - Asymmetric distribution is common
  - Proximal muscles less frequently involved
  - Specific muscles
    - Small muscles in hand frequently involved
    - Quadriceps involvement common: associated with frequent falls
  - Facial muscles frequently involved
  - Extramuscular disease rare: dysphagia is the exception (>50% of patients)
  - May be misdiagnosed as PM, adult-onset muscular dystrophy, or motor neuron disease
  - Associated with other autoimmune diseases

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Necrotizing autoimmune myositis
- Acute or subacute presentation
- Severe proximal muscle weakness: clinically indistinguishable from PM
- May occur in association with cancer, other CT diseases, or drug use (eg, statins)
- Diagnosis of exclusion

Overlap syndrome
- Most common in DM but can occur with other inflammatory myopathies
- Myositis in conjunction with connective tissue disease
  - Most common: systemic sclerosis, mixed connective tissue disease, systemic lupus erythematosus
  - Rash: faint or transient
  - Frequent association with antisynthetase antibodies
  - Myopathy varies from mild to dominant presentation

Juvenile disease
Juvenile dermatomyositis (JDM)
- ~85% of juvenile idiopathic inflammatory myopathy (JIIM)
- Symmetrical and proximal muscle weakness
- Gottron papules
- Heliotrope rash
- Periungual telangiectasia
- Vasculitis: more common than in adults
- Other organs
  - Cardiac
  - Joints
  - Gastrointestinal
  - Pulmonary
- May have family history of other autoimmune diseases
- Amyopathic (hypomypathic form)
  - Inflammatory rashes without muscle weakness
  - ~25% develop full-blown dermatomyositis

Juvenile polymyositis
- 4-8%
  - Proximal and distal muscle weakness
  - Frequent falling episodes
  - Cardiac damage

Juvenile connective tissue disease myositis
- 6-11% of JIIM
  - Occurs in conjunction with another connective tissue disease
  - Raynaud phenomenon
  - Arthritis
  - Malar rash
  - Interstitial lung disease

Diagnostic issues
May be difficult to distinguish between myopathies
- Antibody testing in conjunction with clinical presentation and muscle biopsy help to confirm the diagnosis
- Distinction may be important for therapy and prognosis

Antibody testing
- Myositis-specific antibodies
  - Antisynthetase antibodies
    - Anti-Jo-1 (histidyl-tRNA synthetase): more common in polymyositis
    - Anti-PL7 (threonyl-tRNA synthetase)
    - Anti-PL-12 antibodies (anti-alanyl-tRNA synthetase)
    - Anti-EJ (glycyl-tRNA synthetase)
    - Anti-OJ (anti-isoleucyl-tRNA synthetase)
    - Anti-KS (asparaginyl-tRNA synthetase)
    - Anti-Ha (tyrosyl tRNA synthetase)
    - Anti-Zo (phenylalanyl tRNA synthetase)
  - Nonsynthetase antibodies
    - Anti-signal recognition particle (anti-SRP)
    - Necrotizing myopathy
    - Severe cardiac involvement
    - Anti-p155/140
    - JDM, DM, and ulceration
    - Adults: DM, increased malignancy risk
    - Anti-Mi-2
      - DM
      - Not associated with increased malignancy risk
      - Steroid responsiveness
    - Anti-CADM-140
    - CADM
    - Rapidly progressive ILD
    - Anti-p140
    - JDM, DM, and calcinosis
    - Adults: DM, increased malignancy risk, ILD
    - Anti-SAE
      - DM
    - Anti-HMGCR
    - Necrotizing myopathy
    - Response to short-term statin withdrawal
  - Myositis-associated antibodies: usually associated with connective tissue disease/overlap syndrome
    - Anti-PM-Scl: polymyositis-scleroderma
    - Anti-U1 RNP
    - Anti-Ku
    - Anti-Ro (SSA)

Test Interpretation

Results
- Positive: as a single test, not diagnostic for inflammatory myopathy
- Negative: does not rule out inflammatory myopathy

Limitations
- Results by themselves are not diagnostic; strong clinical correlation is recommended
- Negative results do not rule out a diagnosis of inflammatory myopathy or overlap syndrome