

# Acute Flaccid Myelitis

**Organism:** Acute flaccid myelitis (AFM) may be due to a myriad of viral pathogens, including poliovirus, non-polio enteroviruses (e.g., enterovirus-71), flaviviruses (e.g., West Nile virus, Japanese encephalitis virus, Saint Louis encephalitis virus), herpesviruses (cytomegalovirus and Epstein-Barr virus), certain strains of adenoviruses, and others (Figure 1).

**Incubation period:** Depends on which virus is causing the illness.

**Infectious period:** Variable, depending upon which virus is causing the illness

**Transmission route:** The viruses that are believed to cause AFM may be contagious from one person to another or may be spread by a mosquito or other vector depending on which virus causes the AFM.

**Treatment:** No specific treatment available for AFM other than supportive care to relieve symptoms. If a pathogen with a known definitive treatment is identified (e.g., herpesviruses), specific treatment, if available, for the identified infection should be given.

## Information Needed for the Investigation

In Alaska, clinicians are encouraged to report to the Alaska Section of Epidemiology (SOE) all patients with sudden onset of neurological illness associated with limb weakness that meet the AFM case definition regardless of any laboratory results. Report may be made to SOE by phone (907) 269-8000 or afterhours at (800) 478-0084.

## Verify the Diagnosis

*Clinical picture:* sudden onset of neurological illness associated with limb weakness, AND

- An MRI showing a spinal cord lesion largely restricted to gray matter and spanning one or more segments OR
- Cerebrospinal fluid (CSF) with pleocytosis (white blood cell count  $>5$  cells/mm<sup>3</sup>, adjusting for the presence of red blood cells by subtracting 1 white blood cell for every 500 red blood cells present).

In June 2015, the Council of State and Territorial Epidemiologists (CSTE) adopted a [standardized case definition for acute flaccid myelitis](#).

## Determine the Extent of Illness

- Confirmed cases will be rare; Alaska should have  $< 1$  case/year.
- For the latest surveillance data from CDC visit <http://www.cdc.gov/acute-flaccid-myelitis/afm-surveillance.html>.

## Laboratory Specimens

Clinical specimens (Table 1) from patients that meet the clinical case definition should be promptly collected and shipped to CDC for testing and monitoring in as real-time as possible. Refer to CDC AFM Specimen Collection, Handling and Shipping Instructions for additional information: <http://www.cdc.gov/acute-flaccid-myelitis/hcp/instructions.html>

CDC is no longer requesting that respiratory specimens be collected from suspected cases of AFM. Respiratory specimens that are positive for enteroviruses/rhinoviruses at external labs may be sent to CDC for typing. Stool specimens will continue to be tested to rule out the presence of poliovirus.

*New testing being done at CDC after December 1, 2016 will use assays that are not CLIA-approved and are not intended for clinical diagnosis, thus CDC will not be able to provide individual clinical reports of specific test results. Results that indicate a possible cause of AFM however, will be rapidly disseminated.*

## Hospital Considerations

Use Standard Precautions for patient.

<http://www.cdc.gov/hicpac/2007IP/2007isolationPrecautions.html>

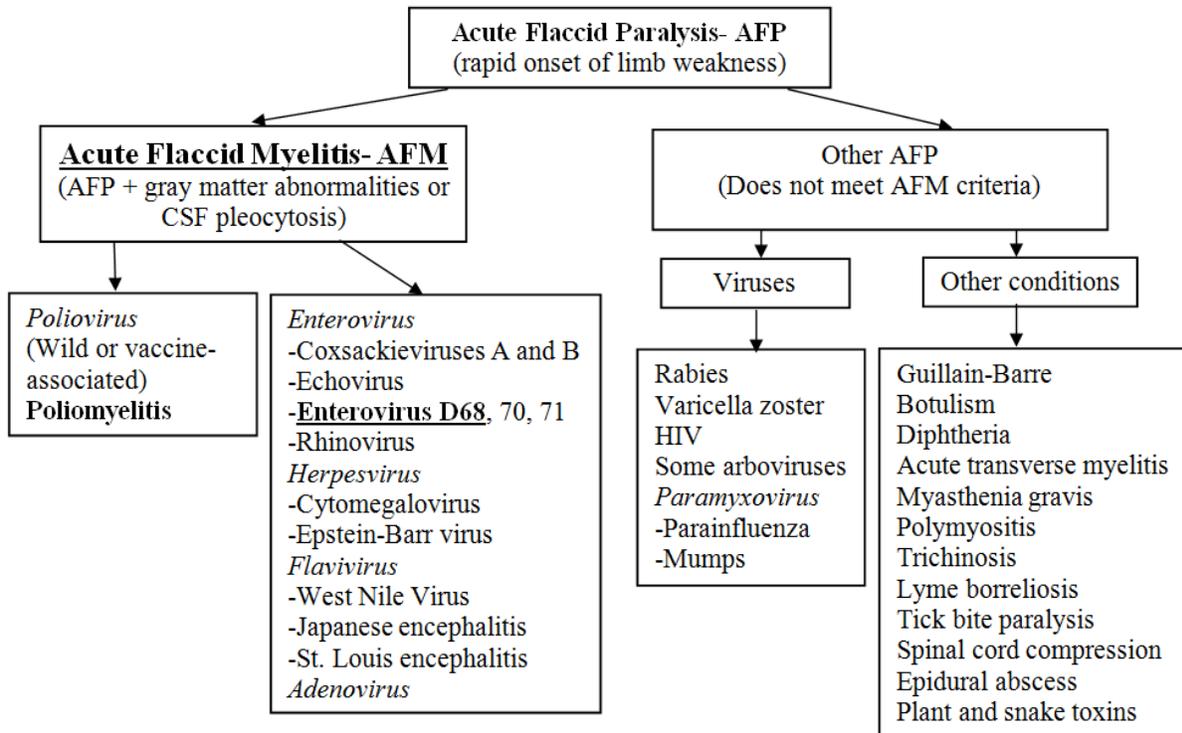
## Contact and Control Measures

- Being up to date on all recommended vaccinations, including poliovirus, is one way to protect yourself and your family from a disease that can cause acute flaccid myelitis. Check with your doctor to make sure your family is up to date on all recommended vaccines.
- You can protect yourself from mosquito-borne viruses such as West Nile virus—another known cause of AFM—  
by using mosquito repellent and staying indoors at dusk and dawn, which is the prime period that mosquitoes bite. Remove standing or stagnant water from nearby property to minimize the number of mosquitoes.
- Protect yourself from other known causes of AFM by:
  - Washing hands often with soap and water
  - Avoid close contact with sick people, and
  - Cleaning surfaces with a disinfectant, especially those that an ill person has touched.

## Reporting Requirements

- Complete AFM Patient Summary Forms (Appendix A) and submit to CDC by email at [limbweakness@cdc.gov](mailto:limbweakness@cdc.gov) or via secure fax at 404-471-8442 for each patient that meets the clinical case definition.
- FTR: write up investigation(s)

**Figure 1. Acute Flaccid Paralysis and Acute Flaccid Myelitis most common etiologies.**  
**Reprinted from Washington State Department of Health by Liliana Sanchez, August 2016.**



**Table 1. Clinical specimens for laboratory testing at CDC.**

Specimen Type	Minimum Amount	Collection	Storage	Shipping	Comments	
<b>Required</b>						
Cerebrospinal fluid (CSF)	2 mL	Unspun; standard cryovial tube; collect at same time or within 24 hours as whole blood	Refrigerate at 4°C	Ship on cold pack overnight	Tubes should be insulated during shipping to ensure they are not in direct contact with cold pack	
Cerebrospinal fluid (CSF)	1 mL	Spun and processed; standard cryovial tube; collect at same time or within 24 hours as whole blood	Freeze at -20°C	Ship on dry ice		
Serum	0.4 mL	Spun and processed; Tiger/red top tube	Freeze at -20°C	Ship on dry ice		
Whole blood	3-5 mL	Lavender/green top tube (with anticoagulant); collect at same time or within 24 hours as CSF	Refrigerate at 4°C	Ship on cold pack overnight	Tubes should be insulated during shipping to ensure they are not in direct contact with cold pack	
<b>Ranked below by first to last preference</b>						
<b>Stool</b>	1. Whole stool	≥1gram	Collect in sterile container, no special medium required	Freeze at -20°C	Ship on dry ice	Two samples total, collected at least 24 hours apart, both collected as early in illness as possible and ideally within 14 days of illness onset
	2. Rectal swab	≥1gram	Store in viral transport medium	Freeze at -20°C	Ship on dry ice	Two samples total, collected at least 24 hours apart, both collected as early in illness as possible and ideally within 14 days of illness onset
<b>Optional</b>						
Respiratory - NP/OP swab	1ml	Store in viral transport medium	Freeze at -20°C	Ship on dry ice	Send only if EV/RV positive for typing	

<i>In the event of death, please send the following specimens, if possible</i>				
Fresh-frozen tissue	Place directly on dry ice or liquid nitrogen	Freeze at -70°C	Ship on dry ice	Representative sections from various organs are requested, but particularly from brain/spinal cord (including gray and white matter), heart, lung, liver, kidney, and other organs as available.
Formalin-fixed or formalin-fixed, paraffin-embedded tissue	Avoid prolonged fixation—tissues should have been fixed in formalin for 3 days, then transferred to 100% ethanol	Room temperature	Ship at room temperature with paraffin blocks in carriers to prevent breakage	See comment above regarding frozen tissue

## **Appendix A – Patient Summary Form**



				Form Approved OMB No. 0920-0009 Exp Date: 06/30/2019
<b>34.</b> Receive any immunosuppressing agent(s) (BEFORE WEAKNESS ONSET)?				<b>35.</b> If yes: Date of first administration: ___/___/_____ Name of medication: _____ Mode of administration: <input type="checkbox"/> IM <input type="checkbox"/> IV <input type="checkbox"/> Oral Dosage / duration / overall amount administered: _____
<b>36.</b> Travel outside the US?				<b>37.</b> If yes, list country:
<b>38.</b> At onset of limb weakness, does patient have any underlying illnesses?				<b>39.</b> If yes, list:
<b>40.</b> On the day of onset of limb weakness, did patient have a fever?				(see definition for fever above in 32.)

**Polio vaccination history:**

<b>41.</b> How many doses of <b>inactivated polio vaccine (IPV)</b> are <b>documented</b> to have been received by the patient before the onset of weakness?	_____ doses	<input type="checkbox"/> unknown
<b>42.</b> How many doses of <b>oral polio vaccine (OPV)</b> are <b>documented</b> to have been received by the patient before the onset of weakness?	_____ doses	<input type="checkbox"/> unknown
<b>43.</b> If you do not have documentation of the <i>type</i> of polio vaccine received what is total number of <b>documented</b> polio vaccine doses received before onset of weakness?	_____ doses	<input type="checkbox"/> unknown

**Neuroradiographic findings:**

**MRI of spinal cord** **44.** Was MRI of spinal cord performed?  yes  no  unknown

**45.** If yes, how many documented spinal MRIs were performed? \_\_\_\_\_

If yes to Q44, complete Q46-Q71 based on **most abnormal spine MRI** **46.** Date of most abnormal spine MRI \_\_\_/\_\_\_/\_\_\_\_\_

**47.** Levels imaged: cervical thoracic lumbosacral unknown

<b>48.</b> Location of lesions:	<input type="checkbox"/> cervical cord <input type="checkbox"/> thoracic cord <input type="checkbox"/> conus <input type="checkbox"/> cauda equina <input type="checkbox"/> unknown	Levels of cord affected (if applicable): <b>49.</b> Cervical: _____ <b>50.</b> Thoracic: _____
For <b>cervical and thoracic cord</b> lesions	<b>51.</b> What areas of spinal cord were affected?	<input type="checkbox"/> predominantly gray matter <input type="checkbox"/> predominantly white matter <input type="checkbox"/> both equally affected <input type="checkbox"/> unknown
	<b>52.</b> Was there cord edema?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown
<b>53.</b> Gadolinium (GAD) used:	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	<b>(If NO, skip to question 59)</b>
For <b>cervical, thoracic cord or conus</b> lesions	<b>54.</b> Did any <b>gray</b> matter lesions enhance with GAD?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown
	<b>55.</b> Did any <b>white</b> matter lesions enhance with GAD?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown
	<b>56.</b> Did any cervical / thoracic nerve roots enhance with GAD?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown
For <b>cauda equina</b> lesions	<b>57.</b> Did the <b>ventral</b> nerve roots enhance with GAD?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown

Public reporting burden of this collection of information is estimated to average 30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information including suggestions for reducing this burden to CDC/ATSDR Reports Clearance Officer; 1600 Clifton Road NE, MS D-74 Atlanta, Georgia 30333.

	58. Did the <b>dorsal</b> nerve roots enhance with GAD?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown
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**MRI of brain**

59. Was brain/brainstem/cerebellum MRI performed?  yes     no     unknown (If NO, skip to Q72)    60. Date of study \_\_\_/\_\_\_/\_\_\_\_\_

61. Any <b>supratentorial</b> (i.e. lobe, cortical, subcortical, basal ganglia, or thalamic) lesions	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	
	62. If yes, indicate location(s)	<input type="checkbox"/> cortex <input type="checkbox"/> basal ganglia <input type="checkbox"/> thalamus <input type="checkbox"/> subcortex <input type="checkbox"/> unknown <input type="checkbox"/> Other (specify): _____
63. Any <b>brainstem</b> lesions?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	
	64. If yes, indicate location:	<input type="checkbox"/> midbrain <input type="checkbox"/> pons <input type="checkbox"/> medulla <input type="checkbox"/> unknown
65. Any <b>cranial nerve</b> lesions?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	
	66. If yes, indicate which CN(s):	CN___ <input type="checkbox"/> unilateral <input type="checkbox"/> bilateral CN___ <input type="checkbox"/> unilateral <input type="checkbox"/> bilateral CN___ <input type="checkbox"/> unilateral <input type="checkbox"/> bilateral CN___ <input type="checkbox"/> unilateral <input type="checkbox"/> bilateral
67. Any lesions affecting the <b>cerebellum</b> ?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	
68. Gadolinium (GAD) used: <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown (If NO, skip to question 72)		
69. Did any supratentorial lesions enhance with GAD?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	
70. Did any brainstem lesions enhance with GAD?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	
71. Did any cranial nerve lesions enhance with GAD?	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	

72. Was an **EMG** done?  yes     no     unknown If yes, date \_\_\_/\_\_\_/\_\_\_\_\_ (mm/dd/yyyy)

73. If yes, was there evidence of acute motor neuropathy, motor neuronopathy, motor nerve or anterior horn cell involvement?  yes     no     unk

**CSF examination:** 74. Was a lumbar puncture performed?  yes     no     unknown

If yes, complete 74 (a,b) (If more than 2 CSF examinations, list the first 2 performed)

	Date of lumbar puncture	WBC/mm3	% neutrophils	% lymphocytes	% monocytes	% eosinophils	RBC/mm3	Glucose mg/dl	Protein mg/dl
74a. CSF from LP1									
74b. CSF from LP2									

**Pathogen testing performed:**

75. Was CSF tested? <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown		Specimen Collection Date ___/___/_____		
If 'yes', was specimen tested for the following:				
	Test Type	Test Result	Typed (if positive)?	Type
<u>Enterovirus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	PCR	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not done	_____
<u>West Nile Virus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	PCR	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending		
<u>West Nile Virus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	IgM	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Indeterminate <input type="checkbox"/> Pending <input type="checkbox"/> Unknown		
<u>Herpes simplex virus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	PCR	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending		
<u>Cytomegalovirus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	PCR	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending		
<u>Varicella zoster virus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	PCR	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending		
<u>Was other pathogen identified:</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	If positive for other pathogen, specify test type: _____	List other pathogen(s) identified: _____		

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**76. Was a RESPIRATORY TRACT specimen tested?**  yes  no  unknown      **Specimen Collection Date** \_\_\_/\_\_\_/\_\_\_\_  
**Type of specimen:**  nasopharyngeal swab  nasal wash/aspirate  oropharyngeal swab  other, specify: \_\_\_\_\_  
**If 'yes', was specimen tested for the following:**

	Test Type	Test Result	Typed (if positive)?	Type
<u>Enterovirus/rhinovirus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	PCR	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not done	_____
<u>Adenovirus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	PCR	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not done	_____
<u>Influenza virus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	PCR	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not done	_____
<u>Was other pathogen identified:</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	If positive for other pathogen, specify test type: _____	List other pathogen(s) identified:		

**77. Was a STOOL specimen tested?**  yes  no  unknown      **Specimen Collection Date** \_\_\_/\_\_\_/\_\_\_\_  
**If 'yes', was specimen tested for the following:**

	Test Type	Test Result	Typed (if positive)?	Type
<u>Non-polio Enterovirus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	PCR	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not done	_____
<u>Poliovirus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	PCR	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending		
<u>Poliovirus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	Culture	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending		
<u>Was other pathogen identified:</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	If positive for other pathogen, specify test type: _____	List other pathogen(s) identified:		

**78. Was SERUM tested?**  yes  no  unknown      **Specimen Collection Date** \_\_\_/\_\_\_/\_\_\_\_  
**If 'yes', was specimen tested for the following:**

	Test Type	Test Result	Typed (if positive)?	Type
<u>West Nile Virus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	PCR	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Pending		
<u>West Nile Virus</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	IgM	<input type="checkbox"/> Positive <input type="checkbox"/> Negative <input type="checkbox"/> Indeterminate <input type="checkbox"/> Pending <input type="checkbox"/> Unknown		
<u>Was other pathogen identified:</u> <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> unknown	If positive for other pathogen, specify test type: _____	List other pathogen(s) identified:		

**79. Was/Is a specific etiology considered to be the most likely cause for the patient's neurological illness?**  yes  no  unknown  
**80. If yes, please list etiology and reason(s) considered most likely cause** \_\_\_\_\_

**81. If patient is a confirmed or probable case, will specimens be sent to CDC for testing?**  yes  no  unknown  
**82. If yes, types of specimens that will be sent to CDC for testing:**  
 CSF  Nasal wash/aspirate  BAL spec  Tracheal aspirate  NP/OP swab  Stool  Serum  Other, list \_\_\_\_\_

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## Acute Flaccid Myelitis case definition

(<http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/2015PS/2015PSFinal/15-ID-01.pdf>)

### Criteria

An illness with onset of acute focal limb weakness AND

- a magnetic resonance image (MRI) showing spinal cord lesion largely restricted to gray matter and spanning one or more spinal segments, OR
- cerebrospinal fluid (CSF) with pleocytosis (white blood cell count  $>5$  cells/mm<sup>3</sup>)

### Case Classification

#### **Confirmed:**

- An illness with onset of acute focal limb weakness AND
- MRI showing spinal cord lesion largely restricted to gray matter and spanning one or more spinal segments

#### **Probable:**

- An illness with onset of acute focal limb weakness AND
- CSF showing pleocytosis (white blood cell count  $>5$  cells/mm<sup>3</sup>).