National Overview of Acute Flaccid Myelitis — United States, 2014–2018

Manisha Patel, MD MS
Measles, Mumps, Rubella, Herpesvirus and Domestic Polio Epidemiology Team Lead

Board of Scientific Counselors
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Acute Flaccid Myelitis (AFM)

- Sudden onset of limb weakness within hours to a few days
- MRI findings demonstrate spinal cord lesions largely restricted to gray matter
- Risk factors unknown, most cases among children with preceding respiratory or febrile illness
- No proven treatment; management of AFM patients in consultation with neurology and infectious disease experts

Initial investigations of AFM in the United States

- 2012, CA: Three patients with limb weakness and anterior myelitis on MRI within 1 month
  - Total of 23 patients identified from 2012–2014
- 2014, CO: Nine patients with limb weakness and spinal cord gray matter lesions with onset dates August–September
- 2014: A national call for additional cases confirmed 120 cases in 34 states from Aug–Dec
  - >5 cases reported from CA, CO, MA, PA and UT

Ayescue, MMWR, 2014; Pastula, MMWR, 2014; Van Haren, JAMA, 2015; Sejvar, CID, 2016
Confirmed case of AFM – Acute onset of limb weakness and magnetic resonance image (MRI) showing a spinal cord lesion largely restricted to gray matter in a patient ≤21 years of age.

Sept 26, 2014: HAN to call for national reporting.

June 2015: CSTE adopted standardized case definition.

Added a probable case definition.

Confirmed case of AFM – Acute onset of flaccid limb weakness, AND an MRI showing a spinal cord lesion largely restricted to gray matter and spanning one or more spinal segments.

Probable case of AFM – Acute onset of focal limb weakness, AND cerebrospinal fluid (CSF) with pleocytosis (white blood cell count >5 cells/mm³).

June 2017: CSTE adopted revisions to case definition.

2014 2015 2016 2017
Number of confirmed AFM cases reported to CDC by month of onset, Aug 2014–Oct 2018 (n=460)*

*Updated figure can be found at: https://www.cdc.gov/acute-flaccid-myelitis/afm-cases.html
Demographic characteristics of confirmed pediatric AFM cases, Aug 2014–Oct 2018 (N=442)

<table>
<thead>
<tr>
<th>Year</th>
<th>2014 (n, %)</th>
<th>2015 (n, %)</th>
<th>2016 (n, %)</th>
<th>2017 (n, %)</th>
<th>2018 (n, %)</th>
<th>Total (n, %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Cases</td>
<td>120 (100)</td>
<td>18 (100)</td>
<td>143 (100)</td>
<td>32 (100)</td>
<td>129 (100)</td>
<td>442 (100)</td>
</tr>
<tr>
<td>Age in years, median (IQR)</td>
<td>7 (5–12)</td>
<td>6 (3–12)</td>
<td>5 (3–9)</td>
<td>9 (3–12)</td>
<td>4.5 (2–7)</td>
<td>6.3 (2–12)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>71 (59)</td>
<td>13 (72)</td>
<td>86 (60)</td>
<td>19 (59)</td>
<td>79 (61)</td>
<td>268 (61)</td>
</tr>
<tr>
<td>Female</td>
<td>49 (41)</td>
<td>5 (28)</td>
<td>57 (40)</td>
<td>13 (41)</td>
<td>50 (39)</td>
<td>174 (39)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AI/AN</td>
<td>1 (1)</td>
<td>0 (0)</td>
<td>3 (2)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>4 (1)</td>
</tr>
<tr>
<td>Asian</td>
<td>8 (7)</td>
<td>2 (11)</td>
<td>8 (6)</td>
<td>0 (0)</td>
<td>3 (2.3)</td>
<td>21 (5)</td>
</tr>
<tr>
<td>Black or African American</td>
<td>8 (7)</td>
<td>6 (33)</td>
<td>24 (17)</td>
<td>7 (22)</td>
<td>13 (10)</td>
<td>58 (13)</td>
</tr>
<tr>
<td>White</td>
<td>79 (83)</td>
<td>8 (44)</td>
<td>78 (55)</td>
<td>17 (53)</td>
<td>85 (66)</td>
<td>267 (60)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>29 (24)</td>
<td>1 (6)</td>
<td>26 (18)</td>
<td>6 (19)</td>
<td>21 (16)</td>
<td>83 (16)</td>
</tr>
<tr>
<td>Not Hispanic or Latino</td>
<td>59 (49)</td>
<td>5 (28)</td>
<td>56 (39)</td>
<td>6 (19)</td>
<td>58 (45)</td>
<td>184 (36)</td>
</tr>
</tbody>
</table>
Clinical characteristics among confirmed pediatric AFM cases, Aug 2014–Oct 2018

Overall (n=442): 37% upper limb weakness only
18% lower limb weakness only

Limb involvement among confirmed AFM cases

Spinal MRI lesions in AFM cases

Overall: 80% cervical lesions
68% thoracic lesions
41% conus lesions
Preceding illness of pediatric confirmed AFM cases, Aug 2014–Oct 2018

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Number of cases</td>
<td>120</td>
<td>18</td>
<td>143</td>
<td>32</td>
<td>129</td>
<td>442</td>
</tr>
<tr>
<td>Any respiratory illness</td>
<td>95 (81)</td>
<td>5 (28)</td>
<td>106 (74)</td>
<td>16 (50)</td>
<td>104 (81)</td>
<td>326 (74)</td>
</tr>
<tr>
<td>Any gastrointestinal illness*</td>
<td>n/a</td>
<td>2 (11)</td>
<td>33 (23)</td>
<td>10 (31)</td>
<td>48 (37)</td>
<td>90 (28)</td>
</tr>
<tr>
<td>Any febrile illness</td>
<td>74 (64)</td>
<td>6 (33)</td>
<td>93 (65)</td>
<td>21 (66)</td>
<td>105 (81)</td>
<td>299 (68)</td>
</tr>
<tr>
<td>Respiratory or febrile illness</td>
<td>105 (90)</td>
<td>8 (44)</td>
<td>122 (85)</td>
<td>23 (72)</td>
<td>125 (97)</td>
<td>383 (87)</td>
</tr>
</tbody>
</table>

*Gastrointestinal illness data collection began mid-2015
AFM diagnostic testing, Aug 2014–Nov 2018

- Cerebrospinal fluid
  - EV-D68, EV-A71, Coxsackievirus A16 in 4 confirmed cases
  - Metagenomics testing in 2014 of 14/35 CSF: GB virus C, human rhinovirus, transfusion-transmitted virus

- Upper respiratory specimen positivity varied
  - 20-30% EV-D68+ during peak years
    - EV-D68 also detected in patients later classified as non-cases
  - ~one-third specimens with other viruses detected, some co-infections
  - ~one-third specimens with no pathogen detected

- All stool tested negative for poliovirus by standard WHO methods
Confirmed cases of acute flaccid myelitis (AFM) by state — United States, 2018 (n=134)*

*Confirmed AFM cases as of November 30, 2018. Patients under investigation are still being classified, and the case counts are subject to change. Case counts will be updated every Monday.
Clinical characteristics among confirmed pediatric AFM cases, 2018 (n=129)

- Hospitalization: 96%
- Intensive care unit admission: 58%
- CSF pleocytosis: 81% (104 cases)
  - Median cell count 104 cells/mm³ (IQR: 51–175 cells/mm³)
  - Lymphocytic predominance
  - Median time from limb weakness to CSF collection 2 days (IQR: 1–3 days)
- No deaths have been reported among cases confirmed in 2018
  - 1 death in 2017 during the acute phase of AFM
  - Aware of deaths this year among cases reported in other years
Clinical characteristics among confirmed pediatric AFM cases, 2018 (n=129)

Overall: 81% febrile illness
81% respiratory illness
37% GI illness

<table>
<thead>
<tr>
<th>Illness type</th>
<th>Median [(IQR), (range)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Febrile illness</td>
<td>2 [(1–5), (0–21)]</td>
</tr>
<tr>
<td>Gastrointestinal illness</td>
<td>2.5 [(1–6), (0–19)]</td>
</tr>
<tr>
<td>Respiratory illness</td>
<td>5 [(3–8), (0–21)]</td>
</tr>
</tbody>
</table>

Days from illness onset to limb weakness, 2018 (n=129)

Proportion of confirmed AFM cases
<table>
<thead>
<tr>
<th>Specimen type (# tested)</th>
<th>Positive samples, n (%)</th>
<th>Organism Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebral Spinal Fluid (n=32)</td>
<td>2 (6)</td>
<td>Enterovirus-A71 (1 adult case)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Enterovirus-D68 (1)</td>
</tr>
<tr>
<td>Respiratory (n=81)</td>
<td>40 (49)¥</td>
<td>Enterovirus-D68 (21)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Enterovirus-A71 (10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rhinoviruses (7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parechovirus (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>¥Non-typed Enterovirus /Rhinovirus (2)</td>
</tr>
<tr>
<td>Stool (n=62)</td>
<td>9 (14)</td>
<td>Enterovirus-A71 (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Enterovirus-D68 (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Echovirus 11 (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coxsackieviruses (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parechovirus (1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non-typed Enterovirus /Rhinovirus (1)</td>
</tr>
</tbody>
</table>
Summary

- Despite the increase in cases this year, AFM is still a rare disease
  - Predominately a pediatric illness
  - Every-other-year rise continues to be observed
  - Limited data suggests new epidemiology since 2014
  - Cases reported in 44 states since 2014

- >85% with a preceding febrile or respiratory illness
  - Virus detected in 50% of respiratory specimens
  - Among 4 confirmed cases since 2014, 3 different viruses identified in CSF
  - Unclear if direct viral invasion of spinal cord versus post-infectious process
    - Limited biopsy or tissue specimens to look at pathology
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Thank you

For more information, contact CDC
1-800-CDC-INFO (232-4636)

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.