

# Acute Flaccid Myelitis

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# Disclosures

- No relevant disclosures
- Brief discussion of off-label medications

# Objectives

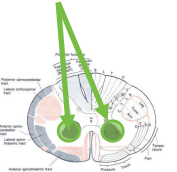
- Identify the presenting symptoms of AFM
- Complete the clinical evaluation for suspected AFM
- Understand management considerations

# What is AFM?

It's in the name!

- **Acute:** Acuity measured in time from symptom onset to nadir
  - <4hrs
    - Stroke
    - Acute cord compression
    - Infection
  - >4hrs to 21 days
    - Inflammatory – TM, NMO, MOG, MS
    - Infection
    - Metabolic
    - Neoplastic

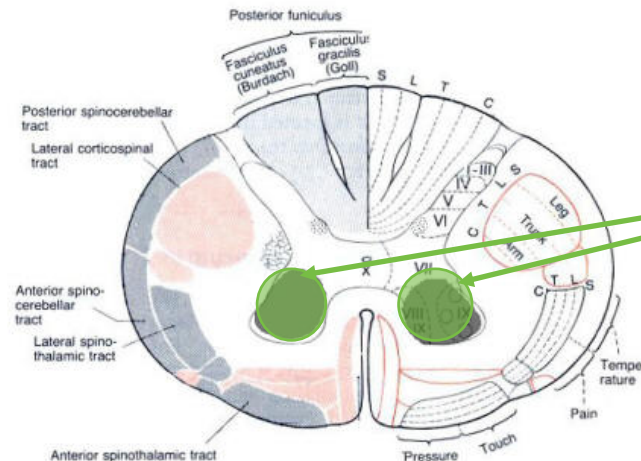
AFM affects primarily the gray matter in the anterior horns



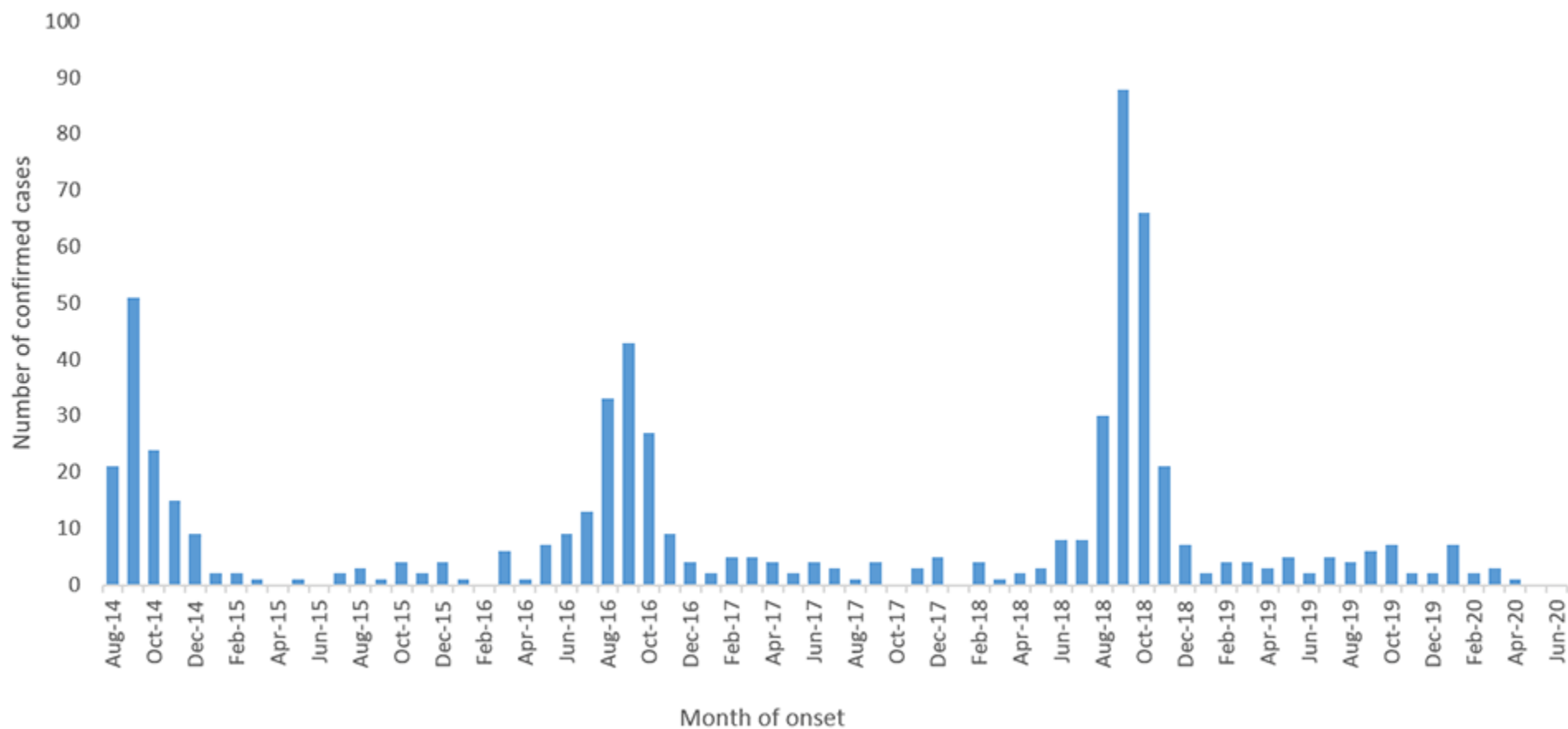
# What is AFM?

It's in the name!

- **Flaccid:** Describing the loss of muscle tone that occurs as a result of anterior horn cell dysfunction
- **Myelitis:** Inflammation of the spinal cord



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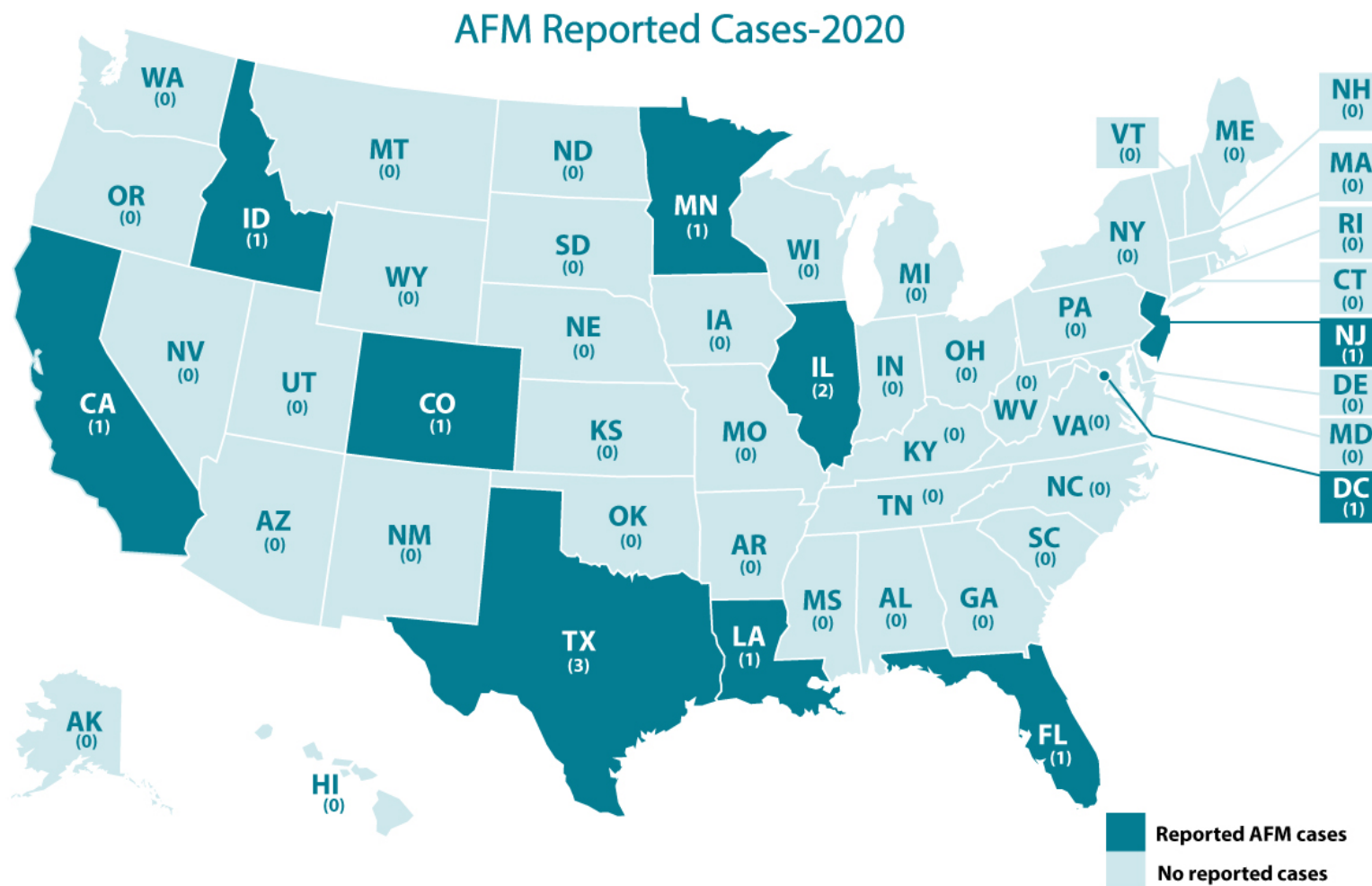
<https://www.cdc.gov/acute-flaccid-myelitis/afm-cases.html>












# AFM

## What causes it?

### A mouse model of paralytic myelitis caused by enterovirus D68

Alison M. Hixon, Guixia Yu, J. Smith Lesser, Shigeo Yagi, Penny Clarke, Charles Y. Chiu, Kenneth L. Tyler 

Published: February 23, 2017 • <https://doi.org/10.1371/journal.ppat.1006199>

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New Results

[Comment on this paper](#)

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- Known historic causes of flaccid myelitis
  - Enteroviruses (Poliovirus)
  - Flaviviruses (West Nile virus, Japanese encephalitis virus)
  - Herpesviruses
  - Adenoviruses

- What about 2014, 2016, 2018 clusters of cases?

# AFM

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Mounting evidence for  
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# Case Illustration

## Presenting Symptoms

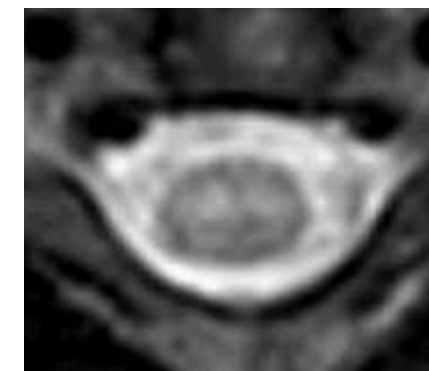
- 3 year old male with a history of mild asthma
- Strep pharyngitis treated over the last week
- Admitted with respiratory distress Sept 14, thought to be asthma exacerbation.
- On night of admission, developed right arm paresis. Weakness progressed over 48hrs to complete flaccid quadriplegia.
- Initially neuro exam: some weak and clumsy movements on left side, almost appeared involuntary/reflexive, right side flaccid, brisk reflexes throughout with upgoing toes.



T2/STIR



T1



AXIAL T2

MRI of the spine w/wo contrast demonstrated hyperintense signal, **predominately affecting the gray matter**, medulla down to about C5. No contrast enhancement.

## Case Illustration

### Imaging



# Case Illustration

## Laboratory Evaluation

Specimen Information: Nasopharyngeal; Nasopharyngeal

Component

4d ago

Respiratory Pathogen

**Rhino/Enterovirus DETECTED !**

	3 9/15/2018 1955	2 9/15/2018 1955	1 9/16/2018 1431
<b>IMMUNOLOGY</b>			
IgG-Quantitative	767	759 *	
IgA-Quantitative	122		
IgM-Quantitative	86		
IgG-CSF		3.4 *	▲
Albumin-CSF		26.9 *	
IgG Index		0.7 *	
IgG Synthesis Rate		3.3 *	▲
ANA Screen	Negative *		
EBV-VCA IgG	>8.0 *		
EBV-VCA IgM	0.5 *		
EBNA-1 IgG	>8.0 *		
EBV-Early Antigen...	<0.2 *		
Cardiolipin IgG	3 *		
Cardiolipin IgM	0 *		
Beta-2 Glyco 1 IgA	0 *		
Mycoplasma IgG Ab			0.05 *
Mycoplasma IgM Ab			0.16 *

	9/15/2018 1908	9/15/2018 1955
<b>OTHER BODY FLUIDS</b>		
CSF to Hold Chemistry	Specimen in lab	
Tube#-CSF	Tube 3	
Glucose-CSF	101 *	▲
Oligoclonal Bands-CSF		Negative *
Total Protein-CSF	58	
WBC-CSF	76 *	▲
RBC-CSF	8	▲
Lymphocytes-CSF	74	
Monocytes-CSF	21	
Color-CSF	Colorless	
Appearance-CSF	Clear	
Xanthochromia-CSF	No	
SEGS-CSF	5	
Eosinophil-CSF	0	
Basophils-CSF	0	

# Case Illustration

## Clinical Course

- Clinical Course – treated with plasmapheresis and steroids. He was intubated due to concurrent pulmonary disease.
- Question of possible neurogenic pulmonary edema, as his presentation was not consistent with asthma. This improved with steroids.
- Received tracheostomy, G-tube, several months in inpatient rehab, slow/limited recovery
- At 2 year follow up, vent only at night, sitting up, left arm gets above head, can move right hand, kicks both legs

# CDC 2020 AFM Case Definition

Clinical case reporting criteria: Changed from any person with acute onset of flaccid weakness to: *a person with acute onset of flaccid weakness AND a lesion in at least some of the gray matter, excluding persons with gray matter lesions in the spinal cord resulting from physician diagnosed malignancy, vascular disease, or anatomic abnormalities.*

- **Confirmed case definition:** *A clinical case with a lesion in the spinal cord on MRI largely restricted to the grey matter, and in the absence of a clear alternative diagnosis (i.e. another nationally notifiable condition)*
- **Probable case definition:** *A clinical case with a lesion in the spinal cord on MRI in which grey matter predominance cannot be distinguished, and in the absence of a clear alternative diagnosis (i.e. another nationally notifiable condition)*
- **Suspect case definition:** *A clinical case without enough information to classify as confirmed or probable, in the absence of a clear alternative diagnosis*

# Typical Presentation

- Acute onset of flaccid weakness (low tone, low reflexes)
- Often in setting of a recent/concurrent febrile illness
- Proximal>distal pattern is common

# Less-Typical Presentation

- Neck stiffness, headache, pain in affected limb may be present
- Cranial nerve abnormalities
- Numbness is an uncommon symptom

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# AFM

## Typical Presentation

**Table I.** Demographics, clinical features, treatment, and outcomes of children with confirmed AFM by CDC criteria in 2014 and 2016

Characteristics*	All	By year		P value†
	(n = 14)	2014 (n = 5)	2016 (n = 9)	
Age (years)	2.6 (0.5-8.8)	5.4 (0.5-7.1)	2.6 (1-8.8)	.640
Male sex	10 (71)	3 (60)	7 (78)	.480
Clinical presentation				
Fever at the time of presentation	8 (57)	1 (20)	7 (78)	<b>.036</b>
Multiple limb involvement	9 (64)	1 (20)	8 (89)	<b>.010</b>
Cranial nerve involvement	1 (7)	0 (0)	1 (13)	.439
Pain on presentation	5 (36)	2 (40)	3 (33)	.803
CSF pleocytosis‡	11 (85)	5 (100)	6 (75)	.224
mRS at symptom nadir	4 (2-5)	2 (2-5)	4 (2-5)	.183

Matesanz S, McGuire J, Hopkins, S.: Acute Flaccid Myelitis: Characteristics and Outcomes of 2014 and 2016 Cases at a Single Center. Journal of Pediatrics July 2019.

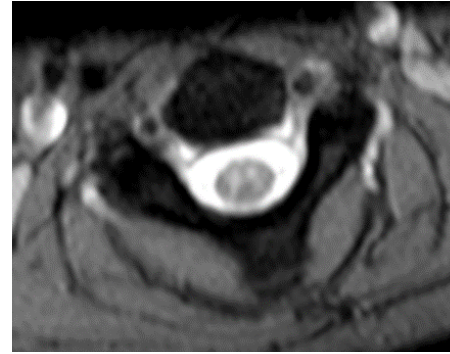
## AFM

## Idiopathic TM

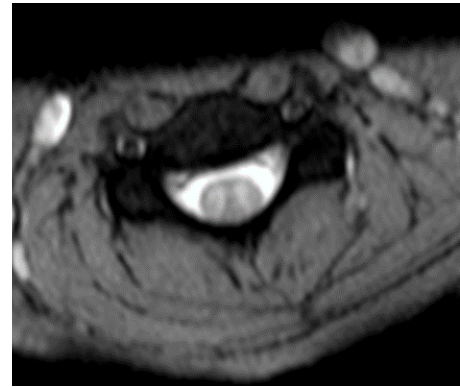
### AFM Imaging



STIR



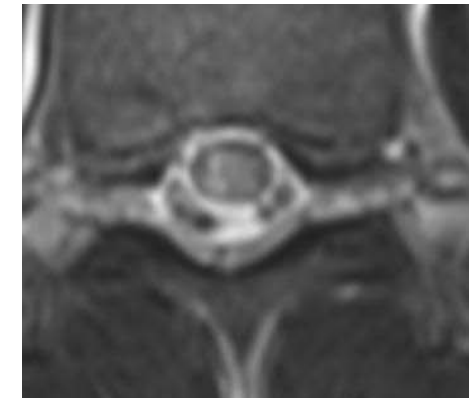
C2



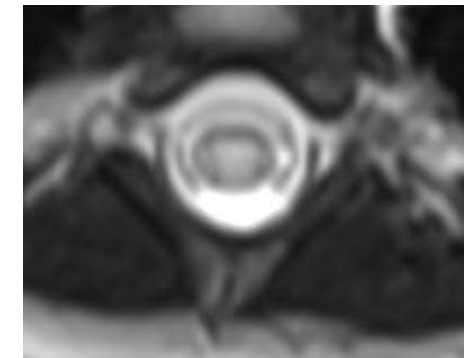
C4



T2



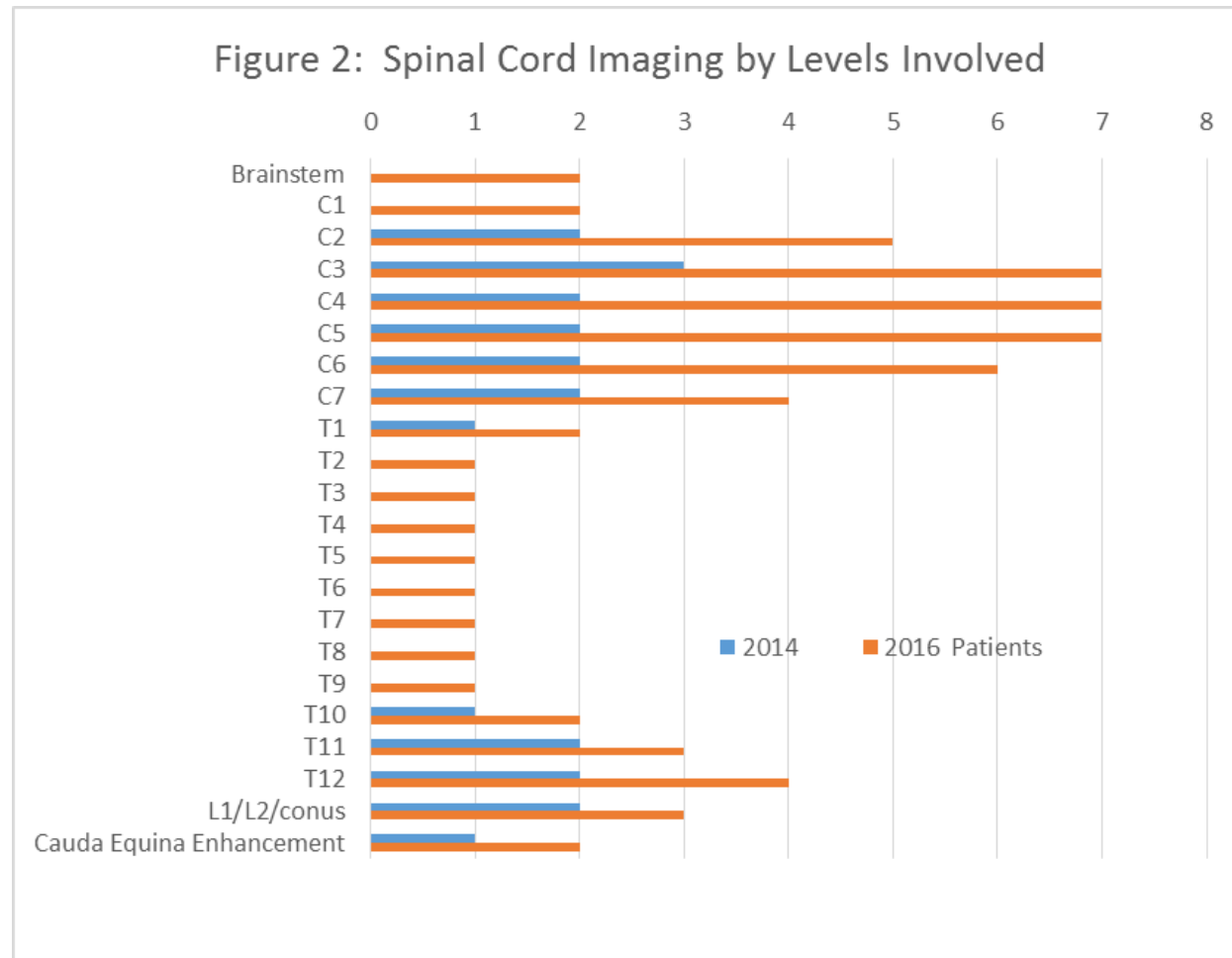
C2



C4



# AFM Imaging



Matesanz, et al. Acute Flaccid Myelitis: Characteristics and Outcomes of 2014 and 2016 Cases at a Single Center. Journal of Pediatrics. 2019.



# AFM Imaging

	CHOP	Hopkins/KKI	TOTAL
<b>Patients with available brain MRI</b>	17	32	49
<b>Gender</b>	11 Males (65%)	9 Males (31%)	20 Males (41%)
<b>Age in years (mean, range)</b>	4.8 (0.5-17)	5.4 (1-16)	5.1 (0.5-17)
<b>Normal brain MRI</b>	11	11	22
<b>Abnormal initial brain MRI</b>	7 (41%)	19 (59%)	26 (53%)
<b>Supratentorial lesions only</b>	0	1 (5%)	1 (4%)
<b>Infratentorial lesions only</b>	5 (71%)	14 (74%)	19 (73%)
<b>Both supra and infratentorial</b>	2 (29%)	4 (21%)	6 (23%)

# AFM

## Diagnostic Testing

- Urgent imaging
  - MRI of the brain and spinal cord
  - Consider thin cuts through area symptoms best localize to
- Lumbar puncture
  - Must coordinate with sedation/radiology to perform immediately following imaging
  - Review imaging prior to procedure
- Blood work
  - Evaluate for other causes of myelopathy/myelitis
- CSF, respiratory (NP/OP), serum, and stool specimens should be also sent to CDC for surveillance testing

# AFM

## Diagnostic Testing to Consider

Category	Individual Studies
<b>CSF</b>	
Basic Studies	Cell count, protein, glucose, cytology, bacterial and viral cultures
Immunology	Oligoclonal bands and IgG Index, Aquaporin 4 IgG
Viral PCRs	Enterovirus, EBV, VZV, HSV, CMV
<b>Serology</b>	
Immunology	Aquaporin-4 IgG, MOG IgG
Screening for auto-immune disorders	ANA, RF, Anti-phospholipid antibody panel, anti-dsDNA (in some situations may also consider chest CT to look for sarcoidosis)
Screening for Infection	Titers for Mycoplasma, Lyme, Bartonella, consider HIV, syphilis
Vitamins	B12, Copper, folate, vitamin E, vitamin D
<b>Additional Studies if Suspected AFM</b>	Enterovirus PCR – CSF, nasopharyngeal swab, urine, stool, serum, WNV serology

Adapted from:

**Yeshokumar A, Hopkins S:** *The Differential Diagnosis and Initial Management of Pediatric Transverse Myelitis*. Current Pediatric Reports 5(1): 30-35, March 2017.

# AFM

## Management

- No universal treatment guidelines
- IV steroids now avoided in setting of active infection
- Plasmapheresis avoided in setting of possible vascular etiology, especially flow-dependent lesions
- IVIG may offer some humoral immunity
- Fluoxetine studied in 2016 and no benefit identified

Tyler, KL. Rationale for the Evaluation of Fluoxetine in the Treatment of Enterovirus D68-Associated Acute Flaccid Myelitis. JAMA Neurol. 2015;72(5):493-494.

Messacar K, Sillau S, Hopkins S, et al. Safety, Tolerability and Efficacy of Fluoxetine as an Antiviral for Acute Flaccid Myelitis. Neurology. 2019 Apr 30;92(18):e2118-e2126.

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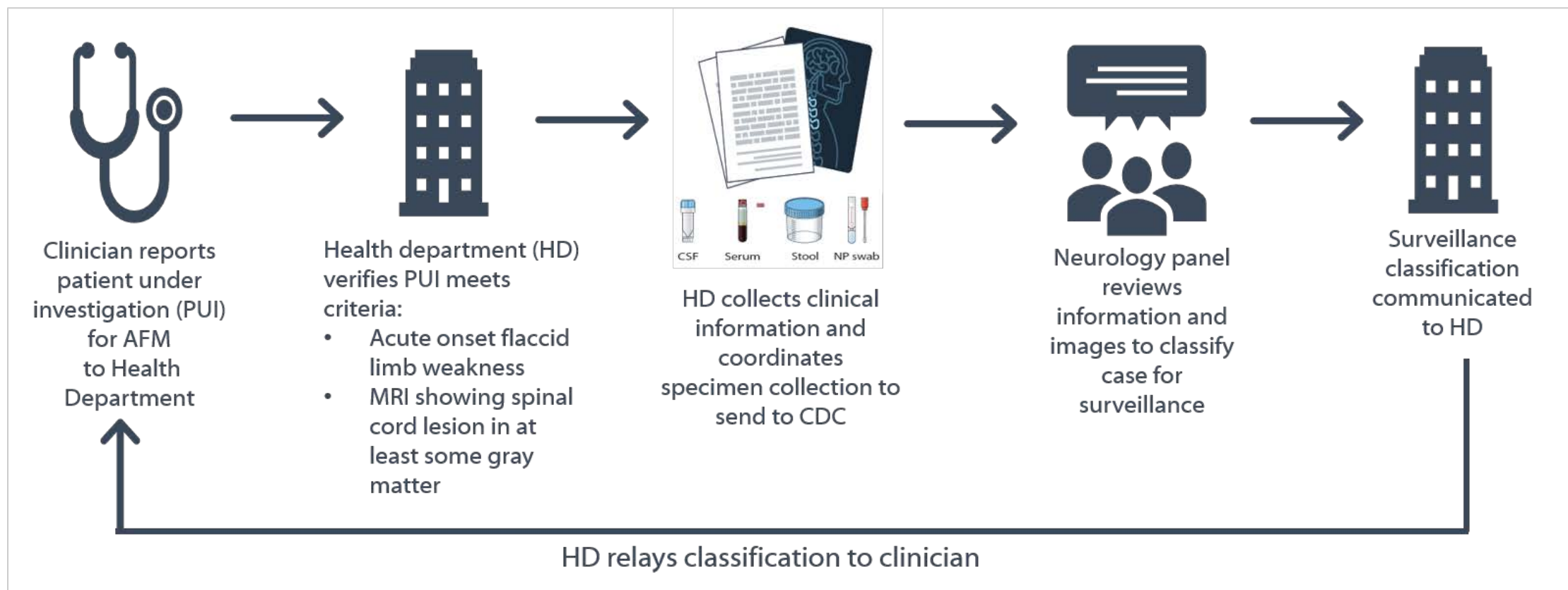
## Management

- Autonomic instability
- Bowel/bladder function
- Respiratory function
  - Respiratory monitor/NIFs, if there is any concern at all, placement should be in ICU

# AFM

## Management

- Thus far, largest improvement in functional recovery noted with time and aggressive rehab
  - Traditional PT/OT
  - E-stim
  - Aquatherapy
  - Assistive Devices
  - Nerve transfer surgery
    - Many patients have some recovery. Factors include muscles and nerves involved, amount of residual activity.



# Questions?

# 2020 RNDS



**M. Mateo Paz Soldán, MD, PhD**

Assistant Professor of Neurology at  
University of Utah Health

**What is Acute Disseminated  
Encephalomyelitis (ADEM)?**