Acute flaccid myelitis in Canada, 2018 to 2019

Catherine Dickson1*, Brigitte Ho Mi Fane1, Susan G Squires1

Abstract

Starting in 2014, biennial clusters of acute flaccid myelitis (AFM), frequently described as “polio-like” illness, have been reported across the United States and elsewhere, often linked to enteroviruses. To assess AFM trends in Canada, we reviewed the Canadian Acute Flaccid Paralysis Surveillance System (CAFPSS) for cases reported during the 2018 and 2019 calendar years that meet the Centers for Disease Control and Prevention case definitions for AFM. A total of 10 cases (8 in 2018 and 2 in 2019) met the confirmed AFM case definition and 30 (26 in 2018 and 4 in 2019) met the probable AFM case definition. Sixty percent of confirmed and probable cases were younger than five years old, and all cases had symptom onset between the months of July and October. Enteroviruses were detected in 50% of confirmed cases. At the time of writing this report, 2020 AFM data were not yet available; it is unknown if a spike in AFM cases will be seen in 2020.

Introduction

Spikes in acute flaccid myelitis (AFM), an emerging form of acute flaccid paralysis (AFP) related to viral infections and frequently described as “polio-like” illness, have been reported in the United States and elsewhere, in a seemingly biennial pattern in the summer and fall, in 2014, 2016 and 2018 (1–5). AFM is not a notifiable disease in Canada; as such, following the increase in AFM cases reported in the United States in 2018, CAFPSS has been leveraged to monitor for AFM as it would

Methods

CAFPSS collects information on cases of AFP in children younger than 15 years old through reports from the Canadian Immunization Program Monitoring Active (IMPACT) and from the Canadian Paediatric Surveillance Program (CPSP). IMPACT is a network of 12 paediatric centres across Canada, representing 90% of paediatric tertiary care beds. CPSP collects information on rare paediatric conditions from a network of over 2,500 paediatricians across the country (12,13). By monitoring for potential cases of polio presenting with AFP, CAFPSS is part of Canada's ongoing efforts to maintain our polio elimination status. CAFPSS collects information on clinical presentation and investigations including laboratory results and magnetic resonance imaging (MRI) reports. All cases in the CAFPSS are adjudicated against the AFP case definition by a specially trained physician.

AFM is not a notifiable disease in Canada; as such, following the increase in AFM cases reported in the United States in 2018, CAFPSS has been leveraged to monitor for AFM as it would
be captured within the broader case definition of AFP. Each confirmed AFP case is reviewed by the adjudicating physician against the CDC case definition to determine the AFM status of AFP cases reported in Canada. For this paper, we used the 2018 CDC case definition for AFM (6):

- A case was classified as confirmed AFM if the MRI results show a spinal cord lesion with predominant grey matter involvement spanning one or more vertebral segments
- A case was classified as probable AFM if the cerebrospinal fluid had a white blood cell count greater than 5 cells/mm³

We extracted 2018 and 2019 AFP data from CAFPSS and aggregated these by year of paralysis/weakness onset. We then conducted descriptive analyses by year, age group, sex, AFM status (using the 2018 CDC case definition), outcome and virology results.

Results

Since the implementation of CAFPSS in 1996, an average of 45 confirmed cases of AFP have been reported to the Public Health Agency of Canada (PHAC) annually, from 27 cases in 1996 and 2019 to 71 cases in 2018 (Figure 1). Between 2018 and 2019, PHAC received 120 reports of sudden onset muscle weakness in children younger than 15 years old. Boys accounted for slightly more than half of all AFM cases (Table 2).

Table 1: Number of confirmed AFP cases reported to the CAFPSS by AFM status, 2018–2019

| Classification   | 2018 | 2019 | Total |
|------------------|------|------|-------|
|                  | n    | %    | n    | %    | n    | %    |
| Confirmed AFP cases | 71   | 100  | 27   | 100  | 98   | 100  |
| Confirmed         | 8    | 11   | 2    | 7    | 10   | 10   |
| Probable          | 26   | 37   | 4    | 15   | 30   | 31   |
| Not AFM           | 23   | 32   | 17   | 63   | 40   | 41   |
| Unable to determine | 14  | 20   | 4    | 15   | 18   | 18   |

Table 2: Age, and number and distribution by age group, sex and outcome of confirmed AFP cases reported to the CAFPSS by AFM status, 2018–2019

| Parameter                  | Confirmed (n=10) | Probable (n=30) | Not AFM (n=40) | AFM status not determined (n=18) |
|----------------------------|------------------|-----------------|----------------|----------------------------------|
| Median age (years)         | 4.9              | 4.8             | 2.9            | 5.8                              |
| Age range                  | (11 months to 13.6 years) | (7 months to 14.5 years) | (3 months to 14.5 years) | (1.5 to 14.8 years) |
| Age group (years)          |                  |                 |                |                                  |
| Younger than 1             | 1                | 10%             | 1              | 3%                              | 5              | 13%             | 0          | 0          |
| 1–4                        | 5                | 50%             | 17             | 57%                             | 24             | 60%             | 8          | 44%        |
| 5–9                        | 3                | 30%             | 6              | 20%                             | 6              | 15%             | 3          | 17%        |
| 10–14                      | 1                | 10%             | 6              | 20%                             | 5              | 13%             | 7          | 39%        |
| Sex                       |                  |                 |                |                                  |                 |                 |            |            |
| Female                     | 4                | 40%             | 14             | 47%                             | 16             | 40%             | 6          | 33%        |
| Male                       | 6                | 60%             | 16             | 53%                             | 23             | 58%             | 12         | 67%        |
| Missing                    | 0                | 0               | 0              | 0                               | 0              | 1               | 3%         | 0          |
| Outcome at the time of most recent case report update | | | | | | | |
| Fully recovered            | 0                | 0               | 7              | 23%                             | 7              | 18%             | 2          | 11%        |
| Partial recovery with residual paralysis/weakness | 3 | 30% | 7 | 23% | 14 | 35% | 6 | 33% |
| Deceased                   | 0                | 0               | 0              | 0                               | 0              | 1               | 3%         | 0          |
| Unknown b                  | 7                | 70%             | 16             | 53%                             | 18             | 45%             | 10         | 56%        |

Abbreviations: AFM, acute flaccid myelitis; AFP, acute flaccid paralysis; CAFPSS, Canadian Acute Flaccid Paralysis Surveillance System

a As of July 24, 2020
b Insufficient information available in the case report to determine if the case definition was met
Of the 10 confirmed AFM cases, all had a symptom onset date between July and October. Probable AFM cases had a symptom onset between January and November, although 87% (n=26) of these had a symptom onset between August and November (Figure 2).

**Figure 2: Confirmed AFP cases reported to PHAC by paralysis or weakness onset date and by AFM status, 2018–2019**

All confirmed and probable cases were hospitalized. The median duration of hospitalization for confirmed AFM cases was 17.5 days (range: 2–70 days) and for probable AFM cases was 12 days (range: 3–46 days). Of the 10 confirmed AFM cases, none had fully recovered at the time of most recent case report update and three (30%) had partially recovered with residual paralysis/weakness. As for the 30 probable AFM cases, seven (23%) had recovered and seven (23%) had partially recovered with residual paralysis/weakness at the time of most recent case report update.

Enteroviruses were detected in five of the confirmed AFM cases: two were positive for EV-D68, one case was positive for EV-A71, one case was positive for enterovirus type unspecified and the remaining case was positive for rhinovirus/enterovirus single target. These viruses were detected through stool samples (n=3), throat swabs (n=1) and nasopharyngeal swabs (n=1). No other viral agents were detected in confirmed AFM cases, although viral testing was performed for all cases.

Of the 30 probable AFM cases, 26 (87%) had viral testing results available. Of these, enteroviruses were detected in 10 (38%) cases: five (50%) had EV-D68, three (30%) had enterovirus type unspecified, one (10%) had EV-A71 concurrent with rhinovirus and one (10%) was positive for rhinovirus/enterovirus single target. These probable AFM cases had enterovirus or rhinovirus/enterovirus single target detected through throat swabs (n=4), nasopharyngeal swabs (n=4), stool samples (n=1) and cerebrospinal fluid (n=1). In addition, six (23%) probable AFM cases had other viral agents detected.

Of the 40 cases classified as not AFM cases, 17 (43%) had viral testing results available. Of these, three (18%) cases tested positive for enteroviruses: one case was positive for enterovirus type unspecified, one for rhinovirus/enterovirus single target and one for rhinovirus/enterovirus single target along with another viral infection. These infections were detected from nasopharyngeal swabs (n=2) and stool samples (n=1). One additional case classified as not AFM was positive for another viral agent.

Of the 18 cases for which AFM status could not be determined, 13 (72%) had viral testing results available. Of these, one case was positive for enterovirus type unspecified detected via a throat swab. The remaining cases were either positive for other viral agents (n=2) or had negative virology results (n=10).

Other viral agents detected in the cases that were not confirmed AFM included bocavirus, adenovirus, rhinovirus, coxsackievirus, Epstein–Barr virus, West Nile virus and norovirus.

**Strengths and limitations**

The increase in AFP case reports in 2018 may be due, in part, to increased awareness of AFM among Canadian clinicians following the increase in number of AFM cases in the United States during that year.

Because the purpose of CAFPSS is to monitor for poliovirus in children, it is not an ideal surveillance tool for AFM. CAFPSS is limited to cases in children younger than 15 years old. As such, the trends described here are limited by data collection availability only for people younger than 15 years. Although cases of AFM have been reported in adults, the majority have been in young children (3). This suggests that CAFPSS can be expected to capture the majority of AFM cases. We anticipate that, although this limitation would reduce overall AFM case counts, it would not affect overall AFM trends.

MRI is essential for the confirmation of AFM. However, in this report, assessments were limited to the information provided to CAFPSS, which were often brief summaries of the MRI report. In other words, it was not possible to ascertain whether some cases met the case definition for AFM. CAFPSS did, however, allow for the use of an existing surveillance tool to monitor trends during periods when spikes in AFM activity have been reported elsewhere and to identify AFM activity related in part to non-polio enterovirus with a similar pattern in seasonality to reports coming out of the United States.

At the time of writing this report, 2020 AFM data were not yet available. The data will need to be analyzed in relation to recent historical trends. It is yet to be seen whether physical distancing...
and infection control practices in the community will reduce the burden of AFM by reducing community transmission of viruses other than coronavirus disease (COVID-19). The authors will continue to monitor reports of AFP and AFM in Canada and work with surveillance partners to ensure ongoing reporting.

Conclusion

In 2018, a record number of AFP cases was reported to CAFPSS, substantially higher than in 2019. A small proportion (10%) of the cases reported from 2018 and 2019 met the 2018 CDC case definition for confirmed AFM, with the majority having onset of paralysis in the late summer and early fall of 2018. This coincides temporally with the cyclical increase in AFM cases observed in the United States (3), suggesting that a similar trend might be occurring in Canada.

A larger proportion of AFP cases (31%) met the 2018 CDC case definition for probable AFM. It is anticipated that a larger proportion of AFP cases would meet the case definition for probable AFM cases given the broad requirement criteria. The CDC has revised the 2020 probable AFM case definition to be more specific (14). We anticipate this greater specificity will lead to fewer diagnosed cases of probable AFM in future years when the new case definition is applied to our surveillance data.

Enterovirus or rhinovirus/enterovirus was detected in non-cerebrospinal fluid specimens of half of the confirmed AFM cases, a greater proportion than seen in any of the other AFM categories. This is consistent with other reports of AFM being linked to enterovirus infections (3,7). No other viral infections were reported in confirmed AFM cases, whereas a variety of other viral infections were reported in each of the other AFM categories, suggesting that these cases might be linked to multiple viral etiologies.

Acknowledgements

The authors would like to thank F Reyes Domingo, M Roy and D MacDonald for their work on acute flaccid paralysis surveillance as well as Dr. J Ahmadian-Yazdi for his assistance with the preparation of this manuscript. The authors would also like to thank the Canadian Paediatric Surveillance Program and the Canadian Immunization Program Monitoring Active (IMPACT) surveillance program, particularly the IMPACT nurse monitors.

Funding

This work was supported by the Public Health Agency of Canada.

References

1. Sejvar JJ, Lopez AS, Cortese MM, Leshem E, Pastula DM, Miller L, Glaser C, Kambhampati A, Shioda K, Aliabadi N, Fischer M, Gregoruccis N, Lanciotti R, Nix WA, Sakthivel SK, Schmid DS, Seward JF, Tong S, Oberste MS, Pallansch M, Feikin D. Acute flaccid myelitis in the United States, August–December 2014: results of nationwide surveillance. Clin Infect Dis 2016 Sep;63(6):737–45. DOI PubMed

2. Ayers T, Lopez A, Lee A, Kambhampati A, Nix WA, Henderson E, Rogers S, Weldon WC, Oberste MS, Sejvar J, Hopkins SE, Pallansch MA, Routh JA, Patel M. Acute flaccid myelitis in the United States: 2015-2017. Paediatrics 2019 Nov;144(5):e20191619. DOI PubMed

3. Lopez A, Lee A, Guo A, Konopka-Anstadt JL, Nisler A, Rogers SL, Emery B, Nix WA, Oberste S, Routh J, Patel M. Vital signs: surveillance for acute flaccid myelitis—United States, 2018. MMWR Morb Mortal Wkly Rep 2019 Jul;68(27):608–14. DOI PubMed

4. Yea C, Bitnun A, Robinson J, Mineyko A, Barton M, Mah JK, Vajsar J, Richardson S, Licht C, Brophy J, Crane M, Desai S, Hukin J, Jones K, Muir K, Pernica JM, Pless R, Pohl D, Rafay MF, Selby K, Venkateswaran S, Bernard G, Yeh EA. Longitudinal outcomes in the 2014 acute flaccid paralysis cluster in Canada: a nationwide study. J Child Neurol 2017 Mar;32(3):301–7. DOI PubMed

5. Skowronski DM, Chambers C, Sabaiduc S, Murti M, Gustafson R, Pollock S, Hoyano D, Rempel S, Allison S, De Serres G, Dickinson JA, Tellier R, Fonseca K, Drews SJ, Martineau C, Reyes-Domingo F, Wong T, Tang P, Krajden M. Systematic community- and hospital-based surveillance for enterovirus-D68 in three Canadian provinces, August to December 2014. Euro Surveill 2015;20(43):pii=30047. DOI PubMed

Authors’ statement

CD — Conceptualization, investigation, writing–original draft, writing–review and editing
BHMF — Methodology, investigation, formal analysis, writing–original draft, writing–review and editing
SGS — Conceptualization, writing–review and editing

Competing interests

None.
6. Centers for Disease Control and Prevention. Acute flaccid myelitis. 2018 case definition. Atlanta (GA): CDC; 2018 (accessed 2020-07-27). https://wwwn.cdc.gov/nndss/conditions/acute-flaccid-myelitis/case-definition/2018/

7. Messacar K, Asturias EJ, Hixon AM, Van Leer-Buter C, Niesters HG, Tyler KL, Abzug MJ, Dominguez SR. Enterovirus D68 and acute flaccid myelitis-evaluating the evidence for causality. Lancet Infect Dis 2018 Aug;18(8):e239–47. DOI PubMed

8. Kimberlin DW, Brady MT, Jackson MA, Long SS, editors. In: Red book: 2018–2021 Report of the Committee on Infectious Diseases, 31st edition. Ithaca (IL): American Academy of Paediatrics; 2018. p. 331–3.

9. McLaren N, Lopez A, Kidd S, Zhang JX, Nix WA, Link-Gelles R, Lee A, Routh JA. Characteristics of patients with acute flaccid myelitis, United States, 2015-2018. Emerg Infect Dis 2020 Feb;26(2):212–9. DOI PubMed

10. Hopkins SE, Elrick MJ, Messacar K. Acute flaccid myelitis—keys to diagnosis, questions about treatment, and future directions. JAMA Pediatr 2019 Feb;173(2):117–8. DOI PubMed

11. Centers for Disease Control and Prevention (CDC). Acute flaccid myelitis: AFM cases and outbreaks. Atlanta (GA): CDC; 2020 (accessed 2020-07-24). https://www.cdc.gov/acute-flaccid-myelitis/cases-in-us.html

12. Public Health Agency of Canada. Surveillance of acute flaccid paralysis. Ottawa (ON): Government of Canada; 2018 (accessed 2020-07-27). https://www.canada.ca/en/public-health/services/surveillance/acute-flaccid-paralysis.html

13. Canadian Paediatric Surveillance Program. Acute flaccid paralysis - Protocols. Ottawa (ON): CPSP (accessed 2020-07-24). https://www.cpsp.cps.ca/uploads/studies/acute-flaccid-paralysis-protocol_1.pdf

14. Centers for Disease Prevention and Control. Acute flaccid myelitis: case definitions for AFM. Atlanta (GA): CDC; 2020 (accessed 2020-07-24). https://www.cdc.gov/acute-flaccid-myelitis/hcp/case_DEFINITIONS.html