



## Epidemiology of Acute Flaccid Paralysis in Hormozgan Province, Iran

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### Abstract

**Background:** Acute flaccid paralysis (AFP) is a syndrome that occurs with the sudden onset of paralysis in any part of the body of infants and children under 15 years old. This study investigated the epidemiology and causes of AFP in patients under 15 years of age admitted to hospitals in Hormozgan province during 2011-2018.

**Materials and Methods:** After receiving the code of ethics, the information of the studied patients was collected by referring to the health center of Hormozgan province and reviewing their records. The corresponding data were gathered using a checklist that included the causes of paralysis, age, gender, place of residence, and involved organs and then analyzed with SPSS software.

**Results:** Out of 121 patients, 58.7% were males. In addition, 69.4% and 21.5% of these patients were in the age groups of 0-5 and 5-10 years, and the remaining cases were in the age group of 10-15 years. In terms of accommodation, 19.8% and 14.9% of patients lived in Bandar Abbas and Minab, respectively. The highest incidence of the disease was 19% and 18.2% in 2013 and 2015, respectively. The most affected organ was 57% of both feet. The most common cause of AFP in this study was Guillain-Barre syndrome (37.2%), followed by transient synovitis (17.4%).

**Conclusion:** Considering the high annual incidence of this disease compared to the standard of the World Health Organization, it is recommended to launch training and vaccination campaigns to reduce the incidence and eradicate this disease.

**Keywords:** Acute flaccid paralysis, Guillain-Barre, Epidemiology

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### Introduction

According to the World Health Organization (WHO), acute flaccid paralysis (AFP) is defined as a disease that suddenly happens with paralysis or weakness in a part of the body of a child under 15 years of age (1, 2). The World Health Assembly in Geneva (1988) issued a resolution approving the eradication of poliomyelitis by 2000 (3). The resolution limited the poliovirus, which was endemic to 125 countries at the beginning of the program except for Afghanistan, Pakistan, India, and Nigeria (2).

The polio eradication program began in Iran in 1991, and an AFP monitoring program was established by the Iranian government in accordance with WHO guidelines in 1998 (4). One of the causes of AFP is the

poliovirus, which is transmitted through anal-oral ways. It is noteworthy that 90-95% of poliovirus infections are asymptomatic and have an incubation period of 7-14 days, causing symptoms similar to common viral infections such as headache, sore throat, fever, nausea, vomiting, weakness, and fatigue. In a number of patients with poliovirus, the involvement of the central nervous system occurs, which causes selective destruction of motor neurons and is characterized by severe back, neck and muscle pain, and motor weakness in some of these patients. AFP occurs in only about 0.1% of poliovirus infections (5, 6). AFP has several underlying causes that can vary with age and geographic area (2).

In the differential diagnoses of AFP, many diseases

have been proposed, the most important of which are poliomyelitis caused by non-polio enteroviruses, Guillain-Barre syndrome, acute axonal neuropathy, and the like. After the eradication of poliovirus, the most common cause of AFP is Guillain-Barre Syndrome, which is an acute or subacute neuropathy that stimulates the immune system and triggers a response, and sensory, motor nerves, which involves autonomy, along with the spinal roots and causes gait disorders (7, 8). This study was performed to prevent the prevalence of the disease and obtain information on its epidemiology in different years, age groups, genders, and involved areas and organs in patients under 15 years of age admitted to hospitals in Hormozgan province during 2011-2018.

### Materials and Methods

This descriptive cross-sectional study aimed to investigate the epidemiology of AFP of patients admitted to hospitals in Hormozgan province. This study focused on all patients less than 15 years old with AFP who were hospitalized in the hospitals of Hormozgan province during 2011-2018 and their medical information was reported to the health center of Hormozgan province. For this purpose, after receiving the code of ethics, the information of 121 patients was collected by referring to the Hormozgan Health Center and reviewing the patients' records using a checklist including the causes of paralysis, age, gender, place of residence, and the involved organ. The causes of AFP encompassed a wide range of diseases, the codes and names of which are listed in Table 1. The age groups were 0-5, 5-10, and 10-15 years. The places of residence included the cities of Hormozgan province and other places that were hospitalized in Hormozgan province.

Data were collected from the records and analyzed by Excel and SPSS software (version 20) using statistical methods.

### Results

Based on the results, patients' stool samples, which were sent to a laboratory for testing for poliovirus, were reported to be negative in all cases.

Among the 121 studied patients, 71 (58.7%) cases were males while 50 (41.3%) of them were females, of which 84, 26, and 11 cases were in the age group of 0-5 (69.4%), 5-10 (21.5%), and 10-15 (9.1%) years, respectively.

In terms of residence status, the highest number of patients lived in Bandar Abbas with 24 subjects (19.8%). Moreover, 18 (14.9%), 15 (12.4%), 13 (10.7%), 11 (9.1%), 11 (9.9%), 8 (6.6%), 8 (6.6%), 5 (4.1%), and 3 (2.5%) subjects lived in Minab, Bastak, Bandar Lengeh, Rudan, Qeshm, Bashagard, Parsian, Sirik, Jask, and Kish, respectively. The lowest number of patients was related to Hajiabad with 2 patients (1.7%).

The highest incidence rates were observed in 2013 and 2015 with 23 (19%) and 22 (2.18%) patients, respectively.

The incidence rate was 12 (9.9%), 15 (4.12%), 15 (4.12%), 19 (7.15%), and 9 (4.7%) subjects in 2012, 2014, 2016, 2017, 2018, respectively, and the lowest incidence rate was detected in 6 subjects (5%) in 2011 (Figure 1).

Both feet were most affected by this disease with 69 cases (57%). The involvement of the left and right feet was found in 17 (14%) and 17 (14%) cases. In addition, the involvement of the right hand and right foot was observed in 11 cases (9.1%), and that of the left foot and left hand was found in 1 case (0.8%). Moreover, the involvement of both feet with the left hand and both feet with the right hand was detected in 2 (1.7%) and 2 (1.7%) cases, respectively (Figure 2).

The most common cause of AFP was Guillain-Barre syndrome with 45 cases (37.2%), followed by transient sinusitis with 21 cases (17.4%) and transient arthropathy in 13 patients (10.7%). Encephalitis after vaccination in 9 cases (5.8%) and viral myositis in 7 cases (7.4%) were the most widespread causes of AFP. On the other hand, the least common causes of this disease included metabolic

**Table 1.** Diagnostic Codes, Number, and Percentage of Causes of Flaccid Paralysis

Flaccid Paralysis Causes	Diagnostic Code	Number	Percentage
Metabolic disorder	E88	1	0.8
Transient synovitis	M65	21	17.4
Encephalitis after vaccination	G04	9	7.4
syndrome Guillain-Barre	G61	45	37.2
Transient stroke	G45	1	0.8
Encephalitis	A85	1	0.8
Myelopathy	G95	1	0.8
Hypokalemia	E87.6	2	1.7
Convulsions	G40	1	0.8
paresis Todd	G83.8	2	1.7
Malignant neoplasms of the brain	D43	2	1.7
Transient arthropathy	M12.8	13	10.7
Viral myositis	M60	7	5.8
Arthritis	M13	2	1.7
Stroke	I64	1	0.8
Acute upper respiratory tract infections	J06	1	0.8
Traumatic nerve infection	T80	1	0.8
Typhoid and paratyphoid fever	A01	1	0.8
Muscle disorders	G71	1	0.8
Muscle weakness	M62	1	0.8
Allergic purpura	D69	2	1.7
Unilateral paralysis of the body	G83	1	0.8
Joint disorders	M25	1	0.8
Other diagnoses	Others	3	2.5

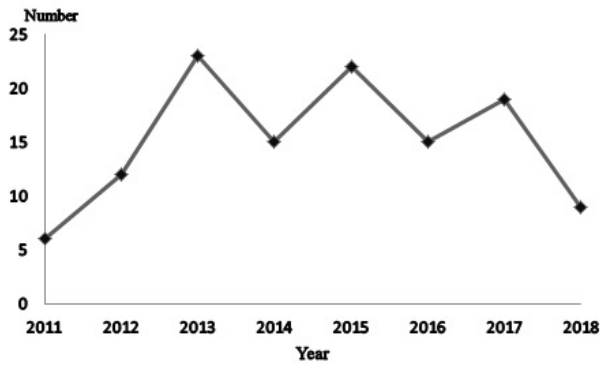


Figure 1. Number of Acute Flaccid Paralysis Cases Reported by Year From 2011 to 2018.

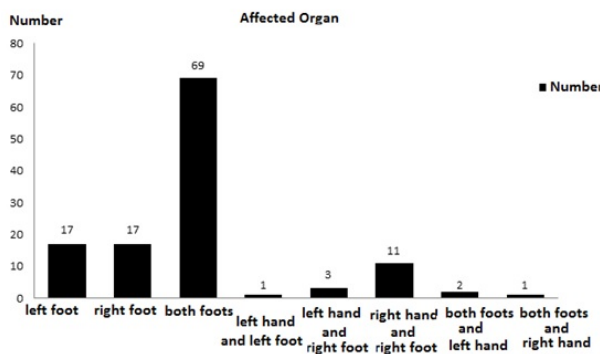


Figure 2. Number of Affected Organs by Acute Flaccid Paralysis.

disorders, transient stroke, encephalitis, myelopathy, seizures, transient arthropathy, stroke, acute upper respiratory tract infections, traumatic nerve infection, typhoid and paratyphoid fever, muscle disorders, allergic purpura, unilateral paresis, and joint disorder, each of which was only reported in 1 case (0.8%). It is noteworthy that 3 cases (2.5%) had other causes not classified in the set of causes of the disease (Table 1).

**Discussion**

In this study, 121 patients with AFP were examined from birth time to 15 years old and were admitted to the hospitals of Hormozgan province during 2011-2018 and their medical data were reported to the health center of Hormozgan province. The incidence rate in males and females was 26.25 and 19.36 per 100,000, respectively, and the ratio of males to females was 1.42, indicating that more males are infected with this syndrome. Mazaheri et al, Bogliun et al, and Arami et al estimated this ratio at 2.4, 1.16, and 1.45, respectively. In almost all published studies, men have a higher incidence compared to women (7, 9, 10)

The results of data from age groups showed that AFP in the first 5 years of life was higher in comparison with other groups (69.4%), which is in line with the results of Soltani et al in Kurdistan, Lam et al in Hong Kong, and

Reynolds. In the study of Kojouharova et al in Bulgaria, the incidence of non-polio AFP was reported to be 3 per 100 000 children under the age of 15 (11-15).

In the present study, according to the population of the age group of 0-15 years in Hormozgan province, which was obtained in the last census in 2016, including 270 409 males and 258 251 females, the incidence of AFP was calculated during 2011-2018. The estimated annual incidence of AFP during 1990-1997 was 1.13, 2.27, 4.35, 2.84, 4.16, 2.84, and 3.6 per 100 000 children, respectively. The incidence of AFP in Hormozgan province is higher than the standard of the WHO (1 case per 100 000 children under 15 years) and has a significant distance, which can be attributed to the low level of health in Hormozgan province. Additionally, high marginalization and high rate of AFP were observed in the neighboring countries (e.g., 4-10.5 per 100 000 people, 18 per 100 000 people, 13.7 per 100 000 people in Afghanistan, Pakistan, and India during 2003-2013, 2007-2011, and 2004-2012 according to previous studies, respectively (16-18).

In other cities of Iran in 2006-2006, the incidence of AFP was reported more than 2% per 100 000 people in some provinces such as Qazvin, Gilan, Lorestan, Mazandaran, Markazi and several other provinces. In 2012, this index was lower than the world standard only in Chaharmahal Bakhtiari, Torbat-e Heydarieh, and Bushehr. In the study by Kojouharova et al in Bulgaria, the incidence of non-polio AFP was reported to be 3 per 100,000 children under the age of 15 (11, 14, 15).

AFP is a syndrome with the differential diagnosis because different diseases can mimic the signs and symptoms of poliomyelitis. The symptoms and involvement of specific organs occurring in this disease can be used for making a more accurate and differential diagnosis between the causes of this disease (11). Diseases cause symptoms similar to polio flaccid paralysis. Therefore, accurate diagnosis requires accurate knowledge of the main etiology and pathology. The findings revealed that none of the patients had poliomyelitis virus, thus there were other reasons for AFP in these people. Guillain-Barre syndrome is one of the most common types, which accounted for 37.2% of cases in this study, which is in conformity with the results of Faheem et al and Soltani et al, and its global incidence varies from 0.4 to 4. Subsequently, transient sinusitis and transient arthropathy were the most prevalent causes of AFP in 17.4% and 10.7% of patients, respectively (11, 17), which conforms to the findings of Morris et al in Australia (19). The results of their study demonstrated that 67 cases (47%) of Guillain-Barre syndrome and 27 cases (19%) transverse myelitis. Further, Kathryn Whitfield in Australia (3) showed that 50% of AFP cases were due to Guillain-Barre syndrome and 19% of cases were due to transverse myelitis. A study by Yasuo Chiba in China (21) reported that of 63 patients with AFP, 40, 7, and 16 cases had Guillain-Barre syndrome, transverse myelitis, and other

causes, respectively. In another study, D'Errico et al (20) concluded that Guillain-Barre syndrome and encephalitis myelitis represented 12 (44.5%) and 5 (18.5%) cases, respectively.

The obtained data from the study of motor paralysis of the limbs showed that most of the involvements related to both feet occurred in 69 cases (57%) and the involvement of each lower limb alone was observed in 17 cases (14%). According to Harrison's book, these muscle cramps are more common in the proximal muscles and the feet compared to the hand, and these individuals have usually normal sensory examinations (22). These findings are important because some people with the poliovirus (e.g., patients with AFP) have involvement of the central nervous system that typically becomes asymptomatic after a few days and presents with the signs and symptoms of meningitis, including neck stiffness, headache, fever, and vomiting. The selective destruction of motor neurons is detected in some of these patients with the poliovirus, which is accompanied by severe pain in the back, neck, and muscles and the weakness of movement (5, 23).

### Conclusion

According to the results of this study, due to the high annual incidence of this disease compared to the WHO standard, more serious support and a more detailed plan are required to reduce the incidence of the disease in line with global standards. Hence, it is recommended to launch educational and vaccination campaigns to eradicate this contagious disease.

### Conflict of Interests Disclosure

The authors declare that they have no conflict of interests.

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### Ethical Statement

The study received ethics approval from the Ethics Committee of Hormozgan University of Medical Sciences (IR.HUMS.REC.1398.198). Patients' information was kept confidential all through research procedures.

### Authors' Contributions

Conceptualization: ARM; Study validation and supervision: AN and SHS; Data analysis and interpretation: SHA and RS and GGH; Writing and reviewing: SHA and MS and ARM.

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### Informed Consent

Not applicable due to the retrospective design.

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