**Original article:**

**Aetiology, Clinical profile and Predictors of adverse outcomes amongst children with Acute Flaccid Paralysis admitted to a tertiary care teaching hospital**

**Dr. Anagha Kulkarni, Dr. Ninad Patil, Dr. Rajesh Kulkarni, Dr. Harshali Vankar,**

**Dr. Rahul Dawre, Dr. Uday Rajput, Dr. Aarti Kinikar**

Name of the Institute/college: B.J. Medical College and Sassoon General Hospital, Pune

Corresponding author: Dr. Aarti Kinikar ; Email id: anaghaklr@yahoo.co.in

**ABSTRACT**

**Introduction:** Acute flaccid paralysis (AFP) is a clinical syndrome characterized by rapid onset of weakness, progressing to maximum severity within several days to weeks. The differential diagnosis of AFP includes polio, Guillain-Barre syndrome, transverse myelitis, etc. The outcomes of AFP are varied and very little is known about the post diagnosis outcomes and the risk factors associated with poor prognosis. Therefore, this study is undertaken to find the aetiology, clinical profile, outcomes and identify factors associated with poor outcome to take corrective steps earlier and hence improve the prognosis.

**Aims and Objectives**: To study the aetiology, clinical profile, outcomes of AFP and to determine the factors associated with poor outcome among AFP cases.

**Materials and Methods:** A prospective observational study was conducted on children with AFP aged between 1 month and 12 years. This study was conducted on children in PICU and ward of a tertiary care teaching hospital at Pune. All children underwent comprehensive examination and investigations on admission and thereafter, received appropriate treatment. Patient outcome at discharge was assessed as partial/complete recovery or death. The data was analysed using STATA 10 software and Fisher’s exact test was used.

**Results and conclusion:** Out of 60 children, Guillian Barre syndrome (GBS) was the most common cause (41.6%) with quadriparesis (41.6%) as common presentation. Out of 60 patients, 42 had partial recovery, 7 had complete recovery and 11 died. Factors associated with poor outcome were sensory and autonomic system involvement, cranial nerve affection, convulsions, late referral and need for mechanical ventilation.

**Keywords:** Acute flaccid paralysis, GBS, Outcome

**Introduction:**

Acute flaccid paralysis is defined as sudden onset of weakness and floppiness in any part of the body, in a child < 15 years of age, or paralysis in a person of any age in whom polio is suspected [1]. AFP is a clinical syndrome characterized by rapid onset of weakness, including (less frequently) weakness of the muscles of respiration and swallowing, progressing to maximum severity within several days to weeks. The term "flaccid" indicates the absence of spasticity or other signs of disordered central nervous system motor tracts such as hyperreflexia, clonus, or extensor plantar responses [2]. The differential diagnosis of acute flaccid paralysis includes paralytic poliomyelitis, Guillain-Barre syndrome (GBS) and transverse myelitis, traumatic neuritis, encephalitis, meningitis and tumours with GBS being the commonest cause. It Is an immune-mediated acute neuropathy with several causative factors including *Campylobacter jejuni* and viral infections [3].

The diagnosis of AFP is mainly clinical, however various supportive investigations are performed including CSF analysis, neuroimaging and electro physiological studies. Electromyography(EMG) and Nerve Conduction Velocity Studies (NCV) [4,5] have supportive role in diagnosis of GBS, to differentiate between axonal and demyelinating subtypes, and could be useful in prediction of prognosis. Treatment of AFP depends on the diagnosis and includes administration of IVIg, steroids, plasmapheresis and supportive treatment. India is declared polio-free, since March 2014, the Global Certification Commission officially certified the World Health Organization’s (WHO) South-East Asia Region [6].

# The outcomes of AFP are varied often including complete or incomplete recovery and long-term neurologic sequelae [7] and very little is known about their post-diagnosis outcomes [8]. However, there are a limited number of studies that determine the risk factors that are associated with poor outcomes in AFP patients. Their knowledge will help in early recognition and aggressive treatment to improve outcomes. Therefore, this study is undertaken to find the aetiology, clinical and electrophysiological profile, outcomes as well as identify factors associated with poor outcome in order to take corrective steps earlier and hence improve the overall prognosis of AFP.

In this study we have studied the causes, type of presentation, outcome of patient at the time of discharge and factors associated with poor outcome.

**Aims and Objectives:**

* To study the aetiology of Acute Flaccid Paralysis (AFP)
* To study the clinical profile of AFP
* To study the outcome of AFP cases at the time of discharge
* To determine the factors associated with poor outcome among AFP cases.

**Materials and Methods:**

The present study was a hospital based prospective observational study conducted at the Paediatric intensive care unit (PICU) and paediatric ward of a tertiary care teaching hospital. 60 children aged between 1 month and 12 years satisfying the inclusion criteria with AFP were enrolled between September 2014 and June 2016. Ethical Approval of the study protocol was obtained from the Institutional Ethics Committee (IEC).

The diagnosis of AFP was based uponthe clinical case definition given by WHO. All the parents were counselled about the study and written informed consent was obtained.All children had comprehensive physical, neurological and systemic examination along with relevant investigations. A standardized data entry form was used to document demographic data, clinical symptoms and signs, laboratory findings, stool sample sent and findings of each patient at presentation. AFP reporting of each case was done to the surveillance medical officer, and each patient was given advise and instructions to properly collect stool sample for AFP analysis. All children received treatment according their diagnosis e.g. IVIg, antibiotics, steroids. Patient outcome at the time of discharge was assessed as partial recovery, complete recovery or death.

The data collected from the proforma was tabulated and analysed using STATA 10 software. Multiple parameters like demographics, type of palsy, diagnosis, symptoms, signs, and intervention were compared with the outcome, to find a significant association. Significant p- value of <0.05 was considered, and calculated using Fisher’s exact test.

**Results and observations:**

This prospective study analysed data of 60 patients presenting with AFP between September 2014 till June 2016. They were analysed for the demographic data (age, sex), type of palsy, diagnosis, clinical features and results of the treatment.

A total of 60 cases of AFP between age group of 1 month to 12 years were studied and the mean age is 5.7 years (SD ±3.5years). Out of 60 cases, 33(55%) were male and 27(45%) were female. The data collected was tabulated and analysed using STATA 10 software. According to diagnosis, out of 60 patients, majority (42%) had GBS, followed by stoke (18%), encephalitis (17%), SOL (8%), TBM (7%), Bell’s palsy and TIA (3%) and least having ADEM (2%). Out of 60 patients, majority (42%) had quadriparesis, 28% had hemiparesis, 15% had paraparesis, 7% had monoparesis, 5% had isolated facial nerve palsy, and least (3%) had isolated bulbar palsy. Out of these, only SOL was significantly associated with a poor outcome of death with a p-value of 0.003 (<0.05).

Out of 60 patients at discharge, 42 had partial recovery (one of which went DAMA), 7 had complete recovery and 11 died. The presence convulsions in patient was found to be associated with poor outcome in the form of death, with significant p-value of <0.001(<0.05). Similarly, presence of sensory involvement, bladder/bowel involvement and cranial nerve involvement was also significantly associated with poor outcome of death with p-values less than 0.05. (Fisher’s exact test used). Other symptoms like preceding URTI and GIT infection was not significantly associated with poor outcome. On comparison of interventions with outcome, late referral of patient to tertiary care hospital was also found to be associated with poor outcome and increased mortality, with significant p-value of 0.0045(<0.05) (Fisher’s exact test used). Similarly, the need for ventilator support was found to be associated with poor outcome, with significant p-value of <0.001(<0.05) (Fisher’s exact test used). PICU care, use of steroids or IVIg did not significantly affect the outcome.

Table no. 1: Characteristics of AFP and outcome

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter |  | N(%) | Survivors | | Deaths | P value |
|  |  |  | Complete recovery | Partial recovery |  |  |
| Demographics | Age <1 year | 8(13) | 2 | 4 | 2 | 0.6307 |
| 1-3 years | 13(22) | 2 | 10 | 1 | 0.4274 |
| 4-6 years | 12(20) | 2 | 7 | 3 | 0.677 |
| 7-10 years | 21(35) | 1 | 16 | 4 | 1.0 |
| >10 years | 6(10) | 0 | 5 | 1 | 1.0 |
|  |  |  |  |  |  |
| Sex male | 33(55) | 6 | 23 | 4 | 0.1968 |
| Sex female | 27(45) | 1 | 19 | 7 | 0.1968 |
|  |  |  |  |  |  |
| Type of palsy | Quadriparesis | 25(42) | 2 | 15 | 8 | **0.0392** |
| Hemiparesis | 17(28) | 4 | 10 | 3 | 1.0 |
| Paraparesis | 9(15) | 0 | 9 | 0 | 0.1888 |
| Monoparesis | 4(7) | 1 | 3 | 0 | 1.0 |
| Isolated facial palsy | 3(5) | 0 | 3 | 0 | 1.0 |
| Isolated bulbar palsy | 2(3) | 0 | 2 | 0 | 1.0 |
|  |  |  |  |  |  |
| Diagnosis | Guillian Barre syndrome (GBS) | 25(42) | 1 | 21 | 3 | 0.325 |
| Stroke | 11(18) | 0 | 11 | 0 | 0.1849 |
| Meningoencephalitis | 10(17) | 4 | 4 | 2 | 1.0 |
| Tubercular meningitis (TBM) | 4(7) | 0 | 2 | 2 | 0.1499 |
| Space occupying lesion (SOL) | 5(8) | 0 | 1 | 4 | **0.003** |
| Transient ischemic attack (TIA) | 2(3) | 2 | 0 | 0 | 1.0 |
| Bell’s Palsy | 2(3) | 0 | 2 | 0 | 1.0 |
| Acute demyelinating encephalomyelitis (ADEM) | 1(2) | 0 | 1 | 0 | 1.0 |

Table no. 2: Risk factors and outcome

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter |  | N(%) | Survivors | | Deaths | P value |
|  |  |  | Complete recovery | Partial recovery |  |  |
| Symptoms and signs | Convulsions | 17(28) | 4 | 4 | 9 | **<0.001** |
| Preceding URTI | 29(48) | 4 | 21 | 4 | 0.506 |
| Preceding GIT infection | 26(43) | 4 | 18 | 4 | 0.739 |
| Sensory involvement | 5(8) | 0 | 2 | 3 | **0.0404** |
| Bladder/Bowel involvement | 16(27) | 1 | 6 | 9 | **<0.001** |
| Cranial nerve involvement | 30(50) | 2 | 18 | 10 | **0.0056** |
|  |  |  |  |  |  |
| Interventions | Late referral | 16(27) | 0 | 9 | 7 | **0.0045** |
| PICU care | 47(78) | 3 | 33 | 11 | 0.0998 |
| Mechanical ventilation | 15(25) | 2 | 2 | 11 | **<0.001** |
| IVIg | 23(38) | 2 | 18 | 3 | 0.5057 |
| Steroids | 44(73) | 6 | 29 | 9 | 0.7104 |

**Discussion:**

This was a prospective hospital based observational study, conducted at a tertiary care teaching hospital. A total of 60 patients with AFP who met the inclusion criteria, between the age group of 1 month to 12 years, admitted in PICU (paediatric intensive care unit) and ward were studied. In the present study, the mean age group was 5.75 years (+SD 3.5 years) out of 60 cases. The most common age group was between 7 to 10 years (35%), followed by 1 to 3 years (21.7%) and 4 to 6 years (20%). In a study of AFP, conducted in Belagavi, Karnataka during June 2014 to July 2016, by Khona Preet et al.[9], 41 cases were studied, with the mean age group of 5 to 9 years (41.4%). In a study conducted by Chaudhary S, Bhatta NK et al. [10], in Nepal, 43 AFP patients were studied with mean age group of 5.6 years (±SD4.1 years). Studies conducted by Rasul CH et al. [11], Ebrahimi Hossein Ali et al. [12], showed similar results. All above AFP studies show that the most common age group for AFP is between 5 to 7 years, similar to our study. This could be because, the children in this age group are prone to bacterial and viral infections predisposing to AFP, unhygienic habits in children, which promotes the spread of infections and trauma.

In the present study, out of 60 cases, 33(55%) were male children and 27(45%) were female children. In AFP study conducted in Belagavi, Karnataka, by Kohna Preet et al. [9], out of 41 cases, 27(65.9%) were male and 14(34.1%) were female. In a study of AFP conducted in tertiary hospital by Kalra Veena, Sharma Anita et al. [13], in AIIMS, New Delhi, out of 70 patients, 47(67.1%) were male and 23(32.8%) were female. Similar studies by CH Rasul et al. [11], Chaudhary S, Bhatta NK et al. [10], show slight male preponderance in AFP cases, similar to our study.

In the present study, out of 60 AFP cases, GBS was the most common cause found in 25(41.6%) cases followed by stroke in 11(18.3%), encephalitis in 10(16.7%) cases and then others. No case of polio was found in our study. In a study conducted by Kohna Preet et al. [9], in Belagavi, Karnataka, out of 41 patients, GBS was the cause in 33(80.5%) patients, followed by post diphtheritic neuritis in 3 patients (7.3%). In a study by CH Rasul et al. [11], out of 43, 16(47.1%) of them had GBS, 9(26.6%) had encephalomyelitis, 5(14.7%) had transverse myelitis. In a study of AFP conducted in tertiary hospital by Kalra Veena, Sharma Anita et al. [13], in AIIMS, New Delhi, out of 70 patients, 43(61.4%) had GBS, 6(8.5%) had transverse myelitis, 6(8.5%) had traumatic neuritis. All the above studies show GBS as most common cause AFP, in areas where polio is uncommon.

The most common presentation of weakness was in the form of quadriparesis in 25(41.6%) patients, hemiparesis in 17(28.4%) patients, followed by paraparesis in 9(15.0%) patients. Monoparesis was seen in 4(6.6%) patients, isolated facial nerve palsy in 3(5%) patients and isolated bulbar palsy in 2(3.4%) patients. Out of 43 patients studied by Chaudhary S et al. [10], 31(72%) patients had quadriparesis, 7(16.2%) had paraparesis, 3(6.9%) had monoparesis, and 2(4.6%) had hemiparesis. In a study by Kalra Veena et al. [13], out of 43 GBS patients, 24(55.8%) had quadriparesis, and 19(44.18%) had paraparesis. Almost all studies have GBS as most common cause of AFP at present scenario and most common clinical presentation is quadriparesis. In this study, out of 60 patients, 17(28.3%) had convulsions and 43(71.6%) had no convulsions. In a study conducted by, Chaudhary S et al., 25(58.1%) children had convulsions out of 43 children [10]. In our study, out of 17 patients who had convulsions, 8 recovered and 9 died. The presence of convulsion was significantly associated with outcome with significant p-value of <0.001(0.05), i.e., those patients who had convulsions had more risk of mortality.

In the present study, out of 60 patients, 5(8.3%) had sensory involvement, and 54 did not have sensory involvement. In a study by Naveed Mohsin et al. [14], out of 106 cases, 10 had sensory involvement in the form paraesthesia. In a study by Chaudhary S et al. [10], sensory loss was present in 5(11.6%)out of 43 patients. In our study, out of 5 patients who had sensory involvement, 2 recovered, and 3 of them died. Significant association was found between sensory involvement and outcome in our study, with p-value of 0.0404(<0.05), which indicates that patients who had sensory involvement, had increased risk of death.

In the present study, out of 60 patients, 16 had bowel/bladder involvement. In a study by Chaudhary S et al, bowel/bladder involvement was present in 12(27.9%) out of 43 patients [10]. Among our 16 patients with bowel/bladder involvement, 7 recovered, and 9 died. When bowel/bladder involvement was compared with outcome, a significant association between them with p-value of <0.001(<0.05) was found, i.e., patients who had bowel/bladder involvement had increased risk of death.

In the present study, cranial nerve involvement was found in 30 out of 60 patients and 10 of them died which had a significant p value of 0.0056(<0.05), which showed that involvement of cranial nerves increased the mortality. The most commonly involved nerves were 7th, 9th and 10th cranial nerves. There was isolated facial nerve palsy in 3 patients (5%), and isolated bulbar palsy in 2 patients (3%). Similarly, in a study by CH Rasul et al [11] out of 34 children of AFP, 5 patients had cranial nerve involvement in the form of bulbar palsy. In a study by Kumbhar Suhas et al., [15] at Sangli, out of 52 patients, 13(25%) had 9th and 10th cranial nerve involvement. In a study by Naveed Mohsin et al [14] in Kashmir, out of 108 cases of AFP, 6 patients had 7th cranial nerve palsy. In a study by Chaudary S et al[10]., out of 43 cases, 3(7%) patients had cranial nerve involvement in the form of bilateral 6th cranial nerve palsy. Different studies showed involvement of different cranial nerve, but most common cranial nerve involved was the 7th cranial nerve. Late referral is a major obstacle to surveillance, early access to health facilities and appropriate treatment [16]. According to Khona Preet et al., late referral delayed the mechanism of rapid diagnosis and also delayed treatment to patients, thus leading to poorer outcomes [9]. Similarly, in the present study, late referral was associated with increased mortality with a significant p-value of 0.0045 (<0.05).

In the present study, out of 60 AFP cases, 15(25%) patients required ventilator support and 45(75%) of them did not require it. In a study, conducted by Chaudhary S and Bhatta NK et al. [10], out of 43 patients, 22(50%) patients had respiratory complication and 17(39.5%) of patients required ventilator support. In a study by Hossein Ali Ebrahimi et al, mechanically ventilated patients constitute the majority of patients with poor outcome, with mortality of 20% [12]. Acute respiratory failure is, most common and serious complication of AFP mainly GBS. Requirement of ventilation is one of the poor prognostic sign of GBS. Meticulous respiratory care and monitoring and recognition of bulbar weakness could possibly reduce the mortality further. In our study, out of 15 patients who were ventilated, 4 of them recovered and 11 of them died, which indicates that the requirement of mechanical ventilation was a poor prognostic factor and was associated with death, with significant p-value of <0.001(<0.05). The need for mechanical ventilation in most cases was due to respiratory failure due to respiratory muscle paralysis, bulbar weakness, or autonomic disturbance and damage to respiratory centres in the brain.

In this study, out of 60 AFP cases, at the time of discharge 42(70%) had partial recovery, out of which one went DAMA , 7(12%) had complete recovery and 11(18%) died. In a study conducted in Iran, by Hossein Ali Ebrahimi et al. [12], out of 147 cases, after 60 days of follow up, 75% of patients showed complete recovery, 18% had partial recovery and 14% died. Most of the studies have GBS as most common cause of AFP; having good prognosis and most of cases recover over the period of time. Most of the studies have done long term follow up of patients to determine the prognosis of GBS patients. In our study we only studied recovery at the time of discharge, so it is one of the limiting factor of our study.

**Conclusions:**

Acute flaccid paralysis is a disease of children with majority of children 35% in the age group of 7 to 10 years. AFP was found to be slightly more predominant in males (55.00%) than in females (45.0%). No case of polio was found. GBS (42%) was the most common type of AFP, followed by stroke (18%), meningoencephalitis (17%) and others. Quadriparesis was the most common type of paralysis found, which was also associated with poor outcome.

Children who had convulsions, sensory involvement, bladder/bowel involvement and cranial nerve affection had increased rates of mortality with significant p-value of <0.05. Children who were referred late to tertiary care hospital had poor outcome and increased rate of death, with significant p-value of 0.0045(<0.05). Patients who required mechanical ventilation had significantly increased death rate, with significant p-value of <0.001. Thus, these were the risk factors associated with poor outcome in the form of death. Overall, majority of patients had partial recovery (70%) with 12% showing complete recovery and a death rate of 18%. To conclude, in our study we found that the poor prognostic factors were; the presence of convulsions, sensory involvement, cranial nerve involvement, bowel/bladder involvement, late referral to tertiary care hospital, and the requirement of ventilator support.

**Limitations:**

The major limitations of the study are inclusion of only a small number of patients, limited availability of Nerve Conduction Study and Electromyography, non-availability of tests like antibodies to GM1 and *Campylobacter* infection. Long term follow-up, after discharge was not done. A multi-centric study with large sample size would be necessary to overcome the limitations of our study.

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