ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 10, Issue, 06(C), pp. 32870-32880, Jun, 2019

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

STUDY OF 57 CASES OF ACUTE FLACCID PARALYSIS IN A TERTIARY CARE HOSPITAL IN INDIA

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DOI: http://dx.doi.org/10.24327/ijrsr.2019.1006.3559

ARTICLE INFO

Article History:
Received 4th March, 2019
Received in revised form 25th April, 2019
Accepted 23rd May, 2019
Published online 28th Jun, 2019

Key Words:
1. Acute flaccid paralysis
2. GBS
3. Hypokalemic paresis
4. Snake bite

ABSTRACT

Acute flaccid paralysis (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.1,5The 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.1,2

We studied 57 cases of acute flaccid paralysis admitted in a tertiary care hospital in west India during the period of 2016 to 2019. Clinical profile of all these patients were studied and various parameters such as age,sex,hospital course,recovery pattern,complications, etc. were recorded.

Flaccid paralysis cases with onset of less than 4 weeks were included for study. All traumatic and spastic paralysis or patients who had flaccidity due to spinal shock were excluded. We found a number of causes for AFP (acute flaccid paralysis) and their characteristics were studied in detail. The results obtained by this study reinforced the fact that, in any patient presenting with AFP, Apart from GBS; other potentially reversible and treatable differentials must be kept in mind (such as hypokalemic paresis, Snake bite etc depending on history and other investigation).

INTRODUCTION

Acute flaccid paralysis (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.[1,5]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.[1,2] With the WHO's impressive progress, poliomyelitis is nearing its eradication in the world,other causes of AFP have gained importance.[5]This study aims to study the clinical characteristics and epidemiology of AFP in adults.

METHODS

The present study was conducted in the Department of Medicine of a Tertiary Care Hospital in West India.

The study Design was Prospective Observational study

The study was conducted between the time period of September, 2016 to August, 2018.

Inclusion Criteria

Patients with

- ✓ Age ≥ 15years
- ✓ History ≤ 4 weeks and
- ✓ Flaccid paralysis
- ✓ were selected.

Exclusion Criteria

All cases of traumatic, spastic, chronic flaccid paresis or due to cerebrovascular accident were excluded from this study. Fifty-Seven patients presenting with weakness of less than four weeks duration, admitted in medical or neurology ward were enrolled in the study after informed consent. Detailed history, clinical examination, and relevant investigations according to a pre-defined proforma were carried out. The patients were followed through their hospital stay till discharge or death. Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS) version 20.0 for Windows (IBM Corporation, Armonk, NY).

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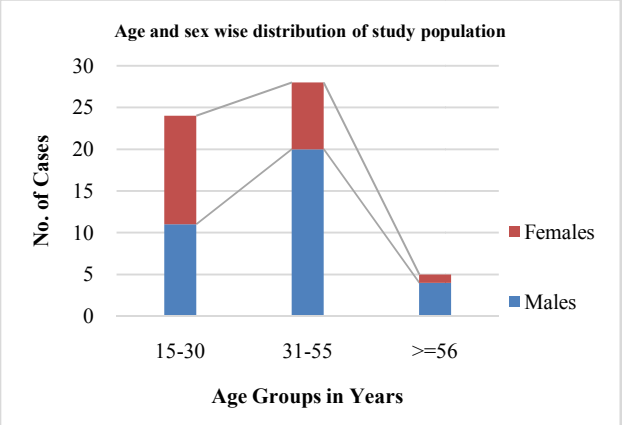
OBSERVATIONS AND RESULTS

Table 1 age and sex wise distribution of study population

Age Groups (In Years)	Males	Females	Total
15-30	11(46%)	13(54%)	24(100%)
31-55	20(71%)	8(29%)	28(100%)
≥56	4(80%)	1(20%)	5(100%)
Total	35(61%)	22(39%)	57(100%)
Mean	36.77	29.45	33.95 ± 14.07

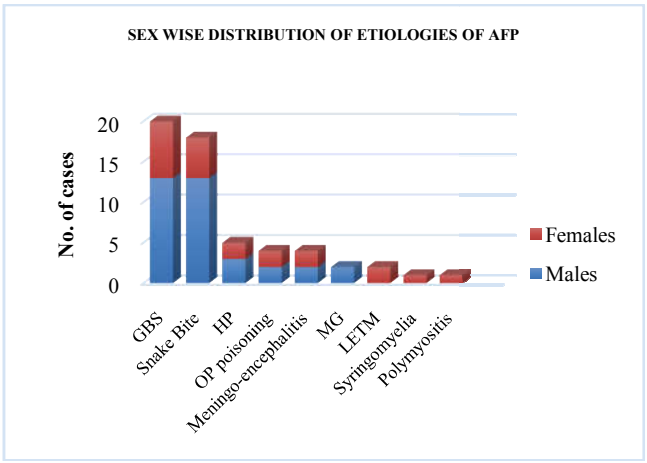


Males constituted 61% of the study population whereas females constituted 39% of the study population.

Table 2 Sex Wise Distribution of Etiologies of Afp

No	Etiology	Males	Females	No. of patients	% of Cases
1	GBS	13	7	20	35
2	Snake Bite	13	5	18	32
3	Hypokalemic Periodic Paralysis	3	2	5	9
4	Organophosphate Poisoning	2	2	4	7
5	Meningo-Encephalitis	2	2	4	7
6	Myasthenia Gravis	2	0	2	3
7	LETM	0	2	2	3
8	Syringomyelia	0	1	1	2
9	Polymyositis	0	1	1	2
Total		35 (61%)	22 (39%)	57	100%

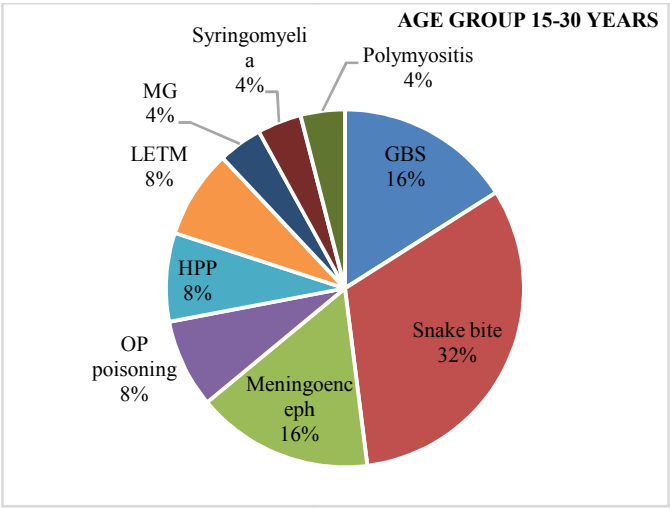
The most common etiology of acute flaccid paralysis in this entire study population was GBS.

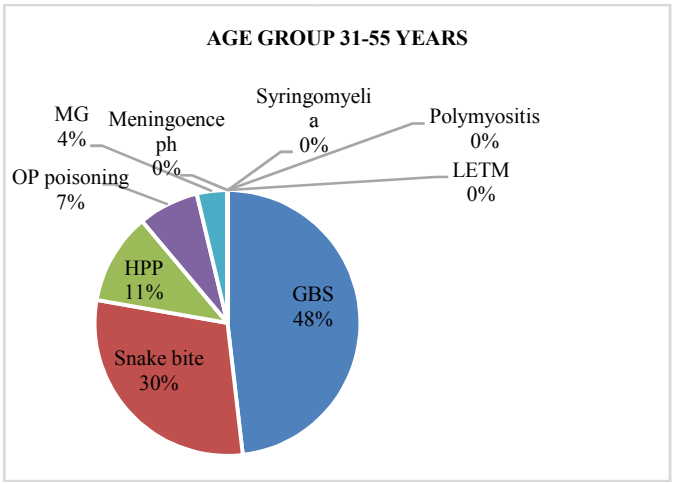


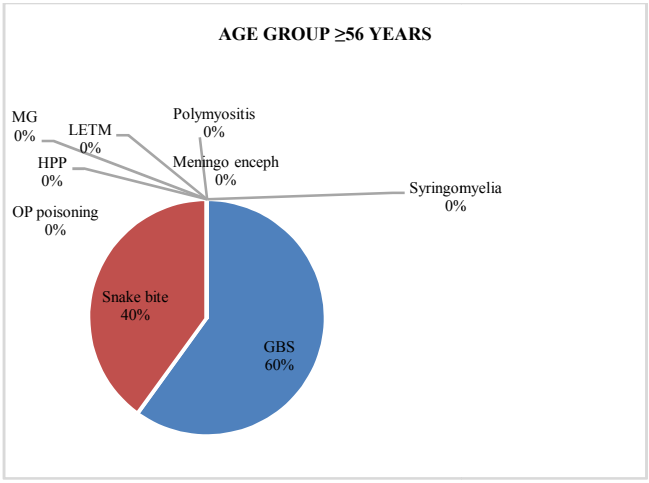
Male preponderance among patients with acute flaccid paralysis in our study was due to higher proportion of males in both snake envenomation and GBS groups. Males are at a higher risk for snake envenomation due to occupational and recreational outdoor activities that predispose them to encounters with venomous snakes. Male preponderance in GBS cases has been reported in our study inconsistence with other studies.[7,9,10] The reasons for male preponderance in GBS are not clear. However, there was no statistically significant difference in etiologies of AFP in males and females (p value 1.12).

Table 3 Age Group Wise Distribution of Etiologies of Afp

Age Groups in years	15-30	31-55	≥56	Total
GBS	4	13	3	20
Snake Bite	8	8	2	18
HP	2	3	0	5
OP poisoning	2	2	0	4
Meningo-encephalitis	4	0	0	4
MG	1	1	0	2
LETM	2	0	0	2
Syringomyelia	1	0	0	1
Polymyositis	1	0	0	1
Total	25 (44%)	27 (47%)	5 (9%)	57 (100%)





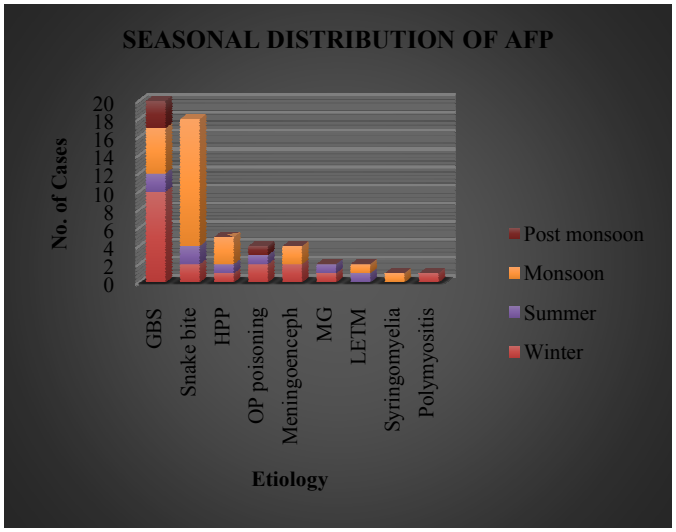


Among individuals younger than 30 years, snake envenomation was the most common etiology encountered (32%) followed by GBS (16%). While In the 31-55 years and ≥ 56 years age groups, GBS was the most common etiology encountered, accounting for 48% and 60% of cases respectively. However, there was no statistically significant difference in the etiologies of AFP in different age groups (p value 0.341).

A preponderance of younger individuals was observed in both GBS (85% < 55 years) and snake envenomation patients (89% < 55 years). Younger population is at a higher risk for snake envenomation due to occupational outdoor activities that predispose them to encounters with venomous snakes.

Table 4 Seasonal Variation in Etiologies of Afp

Season	winter	Summer	Monsoon	Post monsoon	Total
GBS	10	2	5	3	20
Snake bite	2	2	14	0	18
HP	1	1	3	0	5
OP poisoning	2	1	0	1	4
Meningo-Encephalitis	2	0	2	0	4
MG	1	1	0	0	2
LETM	0	1	1	0	2
Syringomyelia	0	0	1	0	1
Polymyositis	1	0	0	0	1
Total	19(33%)	8(14%)	26(46%)	4(7%)	57(100%)

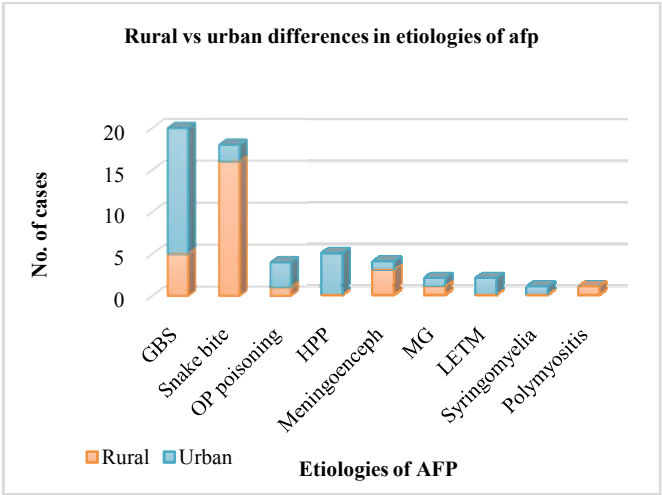


Maximum number of cases of acute flaccid paralysis were encountered during the monsoon period (N = 26, 46%). A marked variation in the epidemiology of acute flaccid paralysis was noted over the four seasons. Majority of cases of neurotoxic snake envenomation were found in monsoon season (N=14, 78%), which was statistically significant (p value <0.05) in contrast to other etiologies of AFP. GBS was encountered more commonly during the post-monsoon and winter periods making 65% of total cases, compared to snakebite, which progressively declined to 11% total, which was also statistically significant (p value<0.05). In the summer months, GBS and snake envenomation were encountered in almost similar frequencies 10% and 11.1%, respectively.

Increased number of acute flaccid paralysis cases seen during the monsoon season were due to increased incidence of snake envenomation as a consequence of flooding of the habitat of snakes and their prey. GBS was seen in higher frequency during post-monsoon and winter. An aberrant immune response to infectious agents like the influenza virus is thought to account for such seasonal variations.[14]

Table 5 Rural v/s urbandistribution of Various Etiologies of Afp

Etiology	Rural	Urban	Total
GBS	5(25%)	15(75%)	20
Snake bite	16(88.89%)	2(11.11%)	18
OP poisoning	1(25%)	3(75%)	4
HP	0	5(100%)	5
Meningoencephalitis	3(75%)	1	4
MG	1(50%)	1(50%)	2
LETM	0	2(100%)	2
Syringomyelia	0	1(100%)	1
Polymyositis	1(100%)	0	1
Total	27 (47.37%)	30 (52.63%)	57 (100%)



Among cases with snake envenomation a significant number (88.89%) were from rural areas. Among cases with GBSsignificant numbers (75%) were from urban areas.This urban VS rural difference in the etiologies of AFP was statistically significant (p value <0.001).

Table 6 Presenting Symptoms and Signs of Afp

Serial no.	Clinical symptoms/signs	No. of Cases
1	Weakness of one/two limbs	8 (14%)
2	Weakness of three/four limbs	49 (86%)
3	Respiratory involvement	34 (60%)
4	Cranial nerve Palsy	36 (63%)
5	Altered sensorium	4 (7%)
6	Convulsion	4 (7%)
7	Bladder-bowel involvement	7 (12%)

8	Sensory symptoms or signs	8 (14%)
9	Fever	5 (9%)

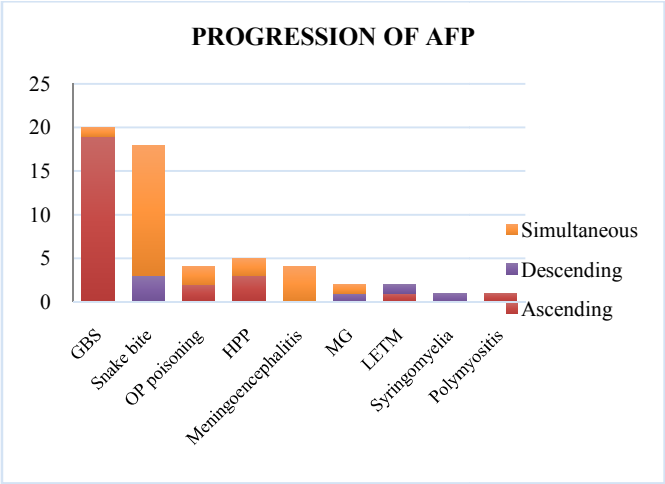
As seen above, 86% of study population had presented with weakness of all four limbs, while 63% and 60% of study population had presented with cranial nerve and respiratory involvement. All the cases presenting with fever, altered sensorium and convulsion were diagnosed to have meningoencephalitis later on. None of GBS and snake bite cases had bladder bowel involvement or convulsion at presentation. Bowel bladder involvement was seen frequently with meningoencephalitis, LETM and syringomyelia cases. Sensory symptoms and signs were present only in 14% of the study population. 9% of cases had presented with fever at onset.

The higher percentage of respiratory involvement in the present study may also be a reflection of referral bias as our hospital being tertiary care hospital, more severe cases requiring mechanical ventilation being referred to our hospital.

Antecedent history of URTI/diarrhea within past two weeks was present in 8 patients with GBS (6 patients had AIDP/AIDP with secondary axonal involvement and one each had AMAN and AMSAN). None of our patient had prior history of vaccination in preceding two weeks.

Table 7 Progression of Afp

Etiology	Ascending paralysis	Descending paralysis	Simultaneous Involvement	Total
GBS	19 (95%)	0	1 (5%)	20
Snake bite	0	3 (17%)	15 (83%)	18
OP poisoning	2 (50%)	0	2 (50%)	4
HP	3 (60%)	0	2 (40%)	5
Meningoencephalitis	0	0	4 (100%)	4
MG	0	1 (50%)	1 (50%)	2
LETM	1 (50%)	1 (50%)	0	2
Syringomyelia	0	1 (100%)	0	1
Polymyositis	1 (100%)	0	0	1
Total	26 (46%)	6 (10%)	25 (44%)	57 (100%)

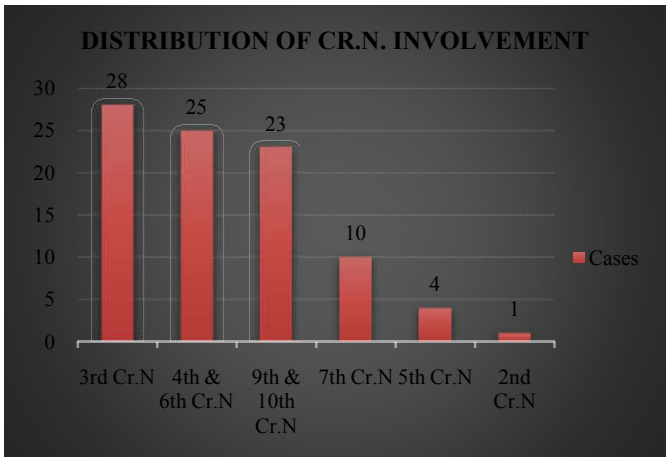


Ascending motor paralysis was the mode of presentation in 46% of the study population. Simultaneous involvement of the upper limbs and lower limbs was noted in 44% of the study population, while descending type of weakness was seen in 10% of thestudy population. Among patients presenting with ascending paralysis, 73% were diagnosed to have GBS. Contrary to this, 60% of total patients with simultaneous onset of weakness in the upper and lower limbs were diagnosed to have snake envenomation. This pattern of progression of AFP in adults is statistically significant (p value <0.05).

95% of total GBS patients had ascending paralysis while 83% of snake bite patients had simultaneous involvement of all four limbs.

Table 8 Cranial Nerve and Respiratory Involvement in Afp

Etiology	2nd Cr. N.	3rd Cr. N.	4th or 6th Cr.N	5th Cr. N	7th Cr. N	9th, 10th Cr.N	Total	Respi.Inv.
GBS	0	3	3	2	5	2	5(14%)	10
Snake bite	0	18	15	0	2	9	18(50%)	14
OP poisoning	0	3	3	0	0	3	3(8%)	3
HP	0	0	0	0	0	3	3(8%)	2
Meningo-encephalitis	0	2	2	2	3	3	3(8%)	4
MG	0	2	2	0	0	2	2(6%)	1
LETM	1	0	0	0	0	0	1(3%)	0
Syringomyelia	0	0	0	0	0	0	0	0
Polymyositis	0	0	0	0	0	1	1(3%)	0
Total	1 (3%)	28 (78%)	25 (69%)	4 (33%)	10 (28%)	23 (64%)	36(63%)	34 (60%)



Total 36 patients (63%) presented initially with weakness in the cranial nerve distribution. Most common cranial nerve involvement was with 3rd cranial nerve (in 78% of cases).

100% cases of snake envenomation had cranial nerve involvement, mostly in form of ptosis and ophthalmoplegia (3rd(in 100% cases) and 4thor 6th (in 83% cases)), followed by 9th& 10th nerve involvement in form of dysphonia and dysphagia in 50% of cases. The involvement of cranial nerves in snake envenomation cases was highly statistically significant (p value <0.05).

Cranial nerve involvement was seen in only 25% of GBS cases. Most common cranial nerve involved in GBS was 7th cranial nerve which was bilateral in distribution, and was seen in all cases of GBS who had cranial nerve involvement. Other cranial nerves involved in GBS patients were 3rd, 4th& 6th; 5th; and 9th& 10th cranial nerves.

Ptosis and ophthalmoplegia along with 9th and 10th cranial nerve involvement in form of dysphagia and dysphonia were seen in all patients of myasthenia gravis. 2nd cranial nerve palsy was observed in only single patient diagnosed as LETM due to NMO.

Respiratory involvement was also noted in 60% of our patient population during hospital stay. Among the patients with respiratory involvement, snake envenomation was the commonest cause (39%) followed by GBS (29%) and meningoencephalitis (11%).

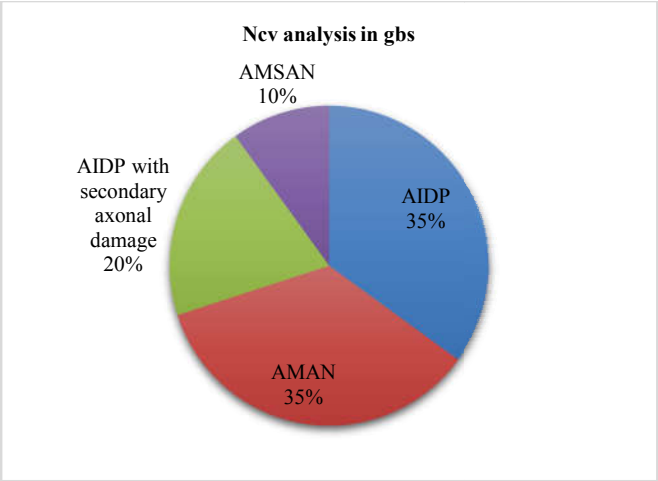
All the five casesdiagnosed as HP (hypokalemic paresis) had very low serum potassium levels (<2.5 mEq/L) in comparison to other causes of AFP. Two of them showed acidosis on ABGA analysis consistent with distal RTA. On further workup their ANA/IF was positive with nuclear speckled pattern and ANA blot was positive for anti Ro and anti La antibodies one each, consistent with Sjogren's syndrome. One another patient had alkalosis on ABGA along with hypokalemia. Further investigations showed patient was hypertensive with normal TSH and uncontrolled blood pressure on three antihypertensive drugs. CECT of abdomen revealed adrenal adenoma with elevated ARR consistent with Conn's syndrome. One of the two remaining patients of HP had very low TSH levels of 0.003 micro IU/ml along with high fT3 and fT4 levels, consistent with thyrotoxic periodic paralysis. Last patient had all blood and routine investigations within normal range, including ABGA, ANA/IF, salivary gland biopsy, TSH, ultrasonography for adrenal adenoma and urinary potassium. He was diagnosed to have hypokalemic periodic paralysis secondary to channelopathies.

A single patient with polymyositis was diagnosed on the basis of 20fold raised CPK total levels on screening test. Diagnosis was confirmed by muscle biopsy showing 1` endomysial CD8/MHC 1 complex inflammation and no vacuoles.Patient was negative for autoantibodies and no occult cancers could be detected.

All the five cases of OP poisoning were diagnosed on the basis of history of exposure to OP compounds and low RBC and Plasma cholinesterase levels.

Table 9 Ncv Analysis in Cases of Gbs

NCV	No. of cases
AIDP + AIDP with secondary axonal damage	7 (35%) + 4 (20%)
AMAN	7 (35%)
AMSAN	2 (10%)
Total	20 (100%)
p value	0.0472



The most common NCV finding in present study was suggestive of AIDP(55%), followed by AMAN(35%). Least common pattern on NCV was AMSAN(10%). This pattern of involvement on NCV was statistically significant with p value of <0.05.

NCV characteristic of AIDP is normal CMAP amplitudes with slow conduction velocities and prolonged distal latencies. Conduction block and temporal dispersion are present and F wave and H reflex can be prolonged or absent. In contrast AMAN shows decreased CMAP amplitude with normal distal latencies and conduction velocities. Conduction block and temporal dispersion are absent and F wave and H reflex can be normal or absent. AMSAN similarly shows decreased SNAP amplitudes.

Table 10 Csf Analysis in Cases of Gbs

GBS variant	Mean CSF protein levels	Albuminocytological dissociation in % of cases
AIDP	80 ± 10 mg/dL	100%
AIDP with 2' axonal inv.	69 ± 6.6 mg/dL	100%
AMAN	62 ± 4.5 mg/dL	100%
AMSAN	59 ± 3.5 mg/dL	100%

CSF analysis in all the cases of GBS showed albuminocytological dissociation which is one of thediagnostic criteria of GBS[1]. Mean protein levels were higher in AIDP variant of GBS compared to variants with axonal damage which was statistically nonsignificant (p value 0.421).Few cases of GBS were subjected to MRI brain and spine, which didn't show any abnormality, whereas all the cases of meningoencephalitis, LETM and syringomyelia had characteristic abnormalities seen on MRI.

Table 11 Mri Abnormalities in Afp

Etiology	Diagnosis	MRI spine	MRI brain
Meningo-Encephalitis	Viral Meningo-Encephalitis	–	Focal subcortical and deep WM and GMlesions, hyperintensities in WM, cortex, pons, cerebral peduncles
	Amoebic Meningo-Encephalitis	–	Multiple T2W hypointense ill-defined non-enhancing lesions with central blooming, peripheral hypointense rim showing diffusion restriction in subcortical both cerebral and cerebellar hemispheres with mild to moderate perifocal edema
	Japanese encephalitis	–	Abnormal signal intensities in b/lthalami extending into the brainstem with areas of restricted diffusion in b/l thalami
	ADEM	–	Supratentorial WM hyperintensities extending from the periventricular region to the subcortical fibers.
Syringomyelia		Small fluid like compartment(Syrinx) extending from C1 to D12	

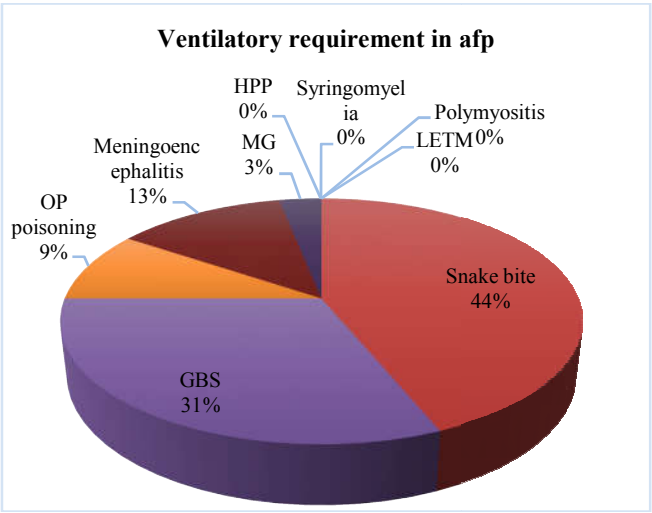
LETM	Tuberculosis	Diffuse long segment centrally located intramedullary cord signal alteration extending from C4 to D3 spinal segments and D7 to L4 spinal segments appearing hyperintense on T2W images without cord expansion	–
	NMO	Long segment myelopathy -high signal lesions over C7 to D4 and D6 to D10 on T2W images.	Bilateral Optic neuritis

CSF viral panel in viral meningoencephalitis patient was negative, while in a patient with Japanese encephalitis, JE IgM ELISA was positive for serum sample and negative for CSF. Amoebic meningoencephalitis was diagnosed on the basis of CSF cytological analysis showing N.fowleri along with consistent MRI findings. ADEM was MRI diagnosis along with consistent clinical features.

NMO was diagnosed on the basis of evidence of optic neuritis with LETM and positivity for serum NMO IgG antibodies. CSF M.tb Gene Xpert was positive for M.tb with sensitivity for both INH and rifampicin in a patient with tuberculous myelitis.

Table 12 Ventilatory Requirement in Afp

Etiology	Cases requiring Ventilatory support at any time during illness	Prolonged mechanical ventilation (≥ 3 weeks)
GBS	10	5
Snake bite	14	0
OP poisoning	3	1
HP	2	0
Meningoencephalitis	4	2
MG	1	1
LETM	0	0
Syringomyelia	0	0
Polymyositis	0	0
Total	34 (60%)	9 (16%)



14(77.7%) cases of Snake envenomation required ventilatory support which was statistically significant (p value <0.05) in comparison to GBS. 4(100%) cases of meningoencephalitis, 3(75%) cases of OP poisoning, 10(50%) cases of GBS and 1(50%) cases of myasthenia gravis required ventilatory support at any time during hospital stay. Prolonged mechanical ventilation, as defined by ventilation for ≥ 21days was observed in 16% of total cases, out of which 55% of cases were accounted for by GBS, other etiologies were meningoencephalitis, OP poisoning and MG. None of snake bite patients required prolonged ventilation, which is in accordance with temporary effects of venomous toxin at NM junction which weans off early, consistent with early recovery observed in snake bite cases compared to GBS in which damage to myelin or axon takes longer time to regenerate, and longer period to recovery.

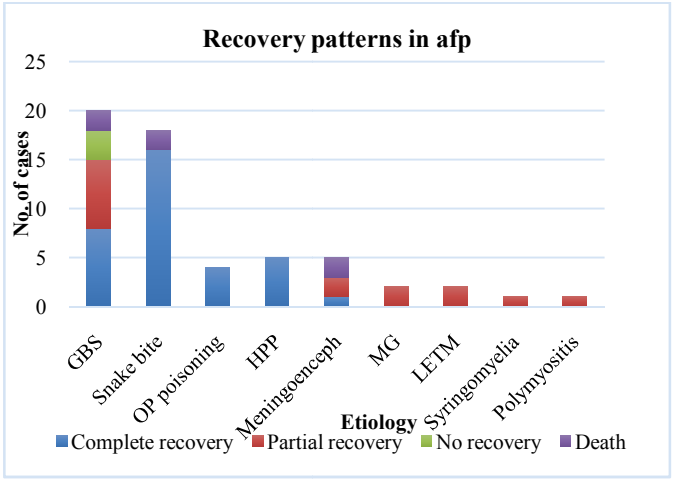
Table 12 Complications in Afp

Complication	No. of cases
Cardiac arrythmias	5 (27.8%)
DVT	3 (16.7%)
Blood stream infection	3 (16.7%)
Bedsore	2 (11.1%)
Aspiration Pneumonia	2 (11.1%0
VAP	2 (11.1%)
URTI	2 (11.1%)
Steroid induced hyperglycemia	2 (11.1%)
Catheter Asso. UTI	1 (5.5%)
ARDS	1 (5.5%)
Local site infection	1 (5.5%)
Total	18 (100%)

Total 18 (31.2%) cases developed complications during their hospital stay. Most common complication was cardiac arrythmias (27.8%) followed by DVT and Blood stream infection16.7% each. Bedsores, URTI, aspiration pneumonia, VAP and steroid induced hyperglycemia constituted 11.1% of complications each. 5.5% complications were caused by Catheter associated UTI, local site infection and ARDS each. Complications were more common with the prolonged duration on ventilator and higher severity of illness as seen by 21 out of 24 cases with one or other complications were on ventilator support (87%) and 62% of cases on ventilatory support developed one or other complication.

Table 13 Recovery Patterns in Afp

At discharge Etiology	Complete recovery	Partial recovery	No recovery	Death	Total
GBS	8 (40%)	7 (35%)	3 (15%)	2 (10%)	20
Snake bite	16 (88.9)	0	0	2 (11.1%)	18
OP poisoning	4 (100%)	0	0	0	4
HP	5 (100%)	0	0	0	5
Meningoencephalitis	1 (20%)	2 (40%)	0	2 (40%)	5
MG	0	2 (100%)	0	0	2
LETM	0	2 (100%)	0	0	2
Syringomyelia	0	1 (100%)	0	0	1
Polymyositis	0	1 (100%)	0	0	1
Total	34 (59.65%)	14 (24.5%)	3 (5.2%)	6 (10.52%)	57 (100%)



In the entire population, 59.65% completely recovered at discharge, 24.5% improved but had residual deficits at

discharge, 10.52% diedand 3 cases (5.2%) had no improvement in muscle power at the time of discharge. While 88.9% of the snake envenomation had complete recovery at discharge, only 40% of the GBS group had a similar outcome. 100% of the OP poisoning, HP cases completely recovered whereas 100% of LETM, MG, Polymyositis, syringomyelia cases had partial recovery at the time of discharge.

A total of 6 (10.5%) patients died in hospital. Two patients had neuroparalytic snakebite, two had GBS, and another two had meningoencephalitis. Respiratory involvement was present in 100% of the patients who died. There was no statistically significant difference among the various etiologies in terms of death as an outcome (P = 0.292).

DISCUSSION

Kaushik, Rupesh *et al*. studied one hundred and thirty-fiveadult patients of AFP where males constituted 67.7% of the total study population, which was similar to our study.The highest number of cases (51.1%) were less than 30 years of age whereas 42.9% were between the ages of 30 and 55, which was in contrast to our study (42% and 49%(highest) respectively). 6.0% were above 55 years of age, which correlated with our study (9%). Mean age of study population was similar in both the studies.

Afp in Urban Vs Rural Population

Study	Present study	Kaushik, Rupesh *et al.*
Urban	52.6%	33.1%
Rural	47.4%	66.9%

Both the studies differed greatly in urban vs rural distribution of study population. This difference may account for further differences in etiologies of AFP between both studies.

Comparison of Spectrum of Etiologies of Afp

Study	Present Study	Kaushik, Rupesh *et al.*
GBS	35.08 %	33.1 %
Snake bite	31.58 %	51.9 %
OP poisoning	8.77 %	0 %
HP	7.02 %	7.5 %
Meningoencephalitis	7.02%	0.8 %
MG	3.51 %	0.8 %
LETM	3.51 %	0.8 %
Syringomyelia	1.75 %	0 %
Polymyositis	1.75 %	0 %
Acute Intermittent Porphyria	0 %	4.5 %
Total	100 %	100 %

Most common etiology of AFP in our study is GBS, which is in contrast to snake envenomation in Kaushik, Rupesh *et al*. study, this is perhaps because two thirds of study population in that study was from rural population, where snake bite dominates as the most important etiology of AFP. Kaushik, Rupesh *et al*.study correlated with our study, in a manner thattwo most common etiologies of acute flaccid paralysis in adults in the both studies are neuroparalytic snake envenomation and Guillain Barre syndrome. These two etiologies accounted for 85% of all the patients. Hypokalemic paralysis (7.5%) was also encountered in considerable numbers in both studies. However, there are differences in the percentage of study populations accounting for meningoencephalitis, early acute transverse myelitis, myasthenia gravis, syringomyelia, polymyositis, OP poisoning and acute intermittent porphyria between two studies, probably because of differences in sample size of two studies. Another study Mohsin, Naveed & Asimi, Ravouf *et al*. also correlated with our study with most common etiology of AFP being GBS (54.7 % cases).Neuroparalytic snakebite has been previously reported as a significant cause of acute flaccid paralysis in young rural men.

Comparision of Seasonal Variation in Etiologies of Afp

Study	Season	Present Study% of total cases in season	Kaushik, Rupesh *et al.*
Snake bite	Winter	25%	6.7%
	Summer	10%	37.1%
	Monsoon	54%	81%
	Post monsoon	0	20%
GBS	Winter	52.6%	80%
	Summer	25%	40%
	Monsoon	19.2%	16.9%
	Post monsoon	75%	50%

In Kaushik, Rupesh *et al*. Study, maximum number of cases of AFP were encountered during the monsoon period (46.7%)which correlated with our study (46%). Similar to our study, it also showed that during the monsoon season, highest cases were due to neurotoxic snake envenomation but numbers differed greatly (54% in our study, 81% in Kaushik, Rupesh *et al*.), probably due to higher proportion of rural population in that study accounting for higher numbers of snake envenomation cases.During the post-monsoon and winter periods GBS dominated as the cause of AFP in the both the studies. This seasonal variability in AFP etiologies was statistically significant(p value <0.001). Brain S, Webb A, Zentar M, *et al*[14] study also showed GBS is significantly more common in winter than in summer (p value 0.007).

In Kaushik, Rupesh *et al*. study among individuals younger than 30 years, snake envenomation was the most common etiology encountered (60.3%) followed by GBS (29.4%) which was similar to our study but percentages differed. In the 31-55 years age group, in contrast to our study, snake envenomation accounted for 45.6% of the cases followed by GBS (35.1%).GBS was the more common etiology encountered in individuals above the age of 55 years, accounting for 50.0% of the cases.Thesedifferences between our study and Kaushik, Rupesh *et al*.could be due to small sample size of our study and differing urban and rural population numbers. In our study, majority of patients with snake envenomation(88.9%) were from rural areas similar to Kaushik, Rupesh *et al* (75%).

Comparision of Progression of Afp

Study	Present study	Kaushik, Rupesh *et al.*
Ascending paralysis	46%	31.6%
Descending paralysis	10%	6.8%
Simultaneous involvement of all limbs	44%	27.1%
Cranial nerve involvement	63%	33.8%

In Kaushik, Rupesh *et al*. study, ascending motor paralysis was the most common mode of presentation (31.6%) similar to our study. Simultaneous involvement of the upper limbs and lower limbs was noted in 27.1% and a descending type of weakness was least common(6.8%) which supports our study.Only 33.8% of the patients in Kaushik, Rupesh *et al*. study presented

initially with weakness in the cranial nerve distribution which didn't correlated with our study.In Kaushik, Rupesh *et al*. study, patients presenting with ascending paralysis, 81.0% were diagnosed to have GBS, which correlated with our study (73.8%) and Similar to our study (60%), 69.4% of patients with simultaneous onset of weakness in the upper and lower limbs were accounted for by snake envenomation.

Comparision of Gbs Variants

Study	Present Study	Shrivastava, Manisha *et al*.[9]	Brain S, Webb A, Zentar M, *et al*.[14]
AIDP	55%	50%	79.2%
AMAN	35%	44%	7.1%
AMSAN	10%	3%	4.3%
MFS	0	0	3.6%
Undetermined	0	3%	5.7%

Our study correlated with other studies, Shrivastava, Manisha *et al*. and Brain S, Webb A, Zentar M, *et al*. with AIDP as the most common GBS variant followed by AMAN and AMSAN.

Comparison of Respiratory Involvement

Study	Respiratory involvement in Present Study	Respiratory involvement in Kaushik, Rupesh *et al.*
GBS	29.4%	25%
Snake bite	41.1%	66%
HP	5.8%	3%
MG	2.9%	1%
Total	60%	75.2%

In Kaushik, Rupesh *et al*. study, Respiratory involvement was noted in 75.2% of patient population during hospital stay andamong the patients with respiratory involvement, snake envenomation was the commonest cause (66%) followed by GBS (25%), hypokalemic paralysis (3%), and myasthenia gravis (1%), similar to our study.Mechanical ventilation was required in 66.2% of cases at any time during hospital stay in Kaushik, Rupesh *et al*. study which correlated with our study (60%). 95.7% of snakebite cases and 56.8% of GBS cases had respiratory involvementin Kaushik, Rupesh, *et al*. study, similar to our study (77.8% and 50 % respectively).

Comparision of Complications

Study	Present study	Kaushik, Rupesh *et al.*
Hospital Acquired Pneumonia	11.1%	15%
Cardiac Arrythmia	27.8%	9%
URTI	11.1%	0.75%
Steroid Induced Hyperglycaemia	11.1%	0.75%
Aspiration Pneumonia	11.1%	0.75%
Catheter induced UTI	5.6%	3%
BSI	16.7%	8.3%
DVT	16.7%	1.5%
Bedsore	11.1%	6%
Local site infection	5.6%	0%
Total	31.6%	29.3%

Similar to our study, in Kaushik, Rupesh *et al* 29.3% of all patients developed one or other complication during hospital stay.Common complications were cardiac arrythmia, HAP, BSI, DVT and bedsores, similar in both the studies.

Comparison of Recovery Patterns

Study	Present study	Kaushik, Rupesh *et al.*
Complete recovery	59.65%	63.2%
Partial recovery	24.5%	18%
No improvement	5.2%	3%
Death	10.52%	9%

Similar to our study,in Kaushik, Rupesh *et al*. 63.2% cases had complete recovery at discharge, 18% improved but had residual deficits at discharge, 9% died,and 4 cases (3%) had no improvement in muscle power at the time of discharge. 88.9% of the snake envenomation cases had complete recovery at discharge, only 25.0% of the GBS group had a similar outcome which correlated with our study(88.9% and 40% respectively in our study). 9% patients died in Kaushik, Rupesh *et al* study, which supports our study. Outcomes in acute flaccid paralysis patients were skewed due to preponderance of snake envenomation, a potentially reversible condition. Majority of neuroparalytic snakebite patients improved completely (88.9%).Prognosis of neuroparalytic snakebite patients was excellent if care was provided before development of complications. On the other hand, majority ofpatients with GBS were improving but had residual weakness at the time of discharge (35%). This is because, in this study, patients were followed only till time of discharge. Patients of GBS take longer to recover fully (weeks to months) as compared to those of neuroparalytic snakebite, who improve within days.

Our study has a few limitations. Being a single-center study in Western India, our observations may not be representative of the entire country. As this study was conducted in a tertiary care referral center, our patients included the more severely afflicted along the spectrum of flaccid paralysis as evidenced byhigher need for mechanical ventilatory support. The less severe cases may not have reached us and skewed our results. Larger sample size and longer duration of follow-up is necessary to identify other conditions causing acute flaccid paralysis and their long-term outcomes.

Summary

- 42% of cases of AFP in our study were less than 30 years of age. 49% of cases were between the ages of 30 to 55 years and only 9% were above the age of 55 years. The mean age of study population was 33.95 years.
- Males constituted 61% of the study population whereas females constituted 39% of the study population.
- The most common etiology of acute flaccid paralysis in this entire population was GBS (35%) followed by the neuroparalytic snake envenomation (32%), Hypokalemic paralysis (9%), Organophosphate poisoning (7%) and meningoencephalitis (7%), longitudinally extensive transverse myelitis (3%) and Myasthenia Gravis (3%), Syringomyelia (2%) and polymyositis (2%).
- In individuals younger than 30 years, snake envenomation was the most common etiology of AFP (32%) followed by GBS (16%). While In the 31-55 years and ≥ 56 years age groups, GBS was the most common etiology, accounting for 48% and 60% of cases respectively.
- Neurotoxic snake envenomation was commonly encountered in monsoon season (N=14, 78%)which was statistically significant (p value<0.05). In contrast, GBS was encountered more commonly during the post-

monsoon and winter periods making 65% of total cases, which was also statistically significant (p value <0.05).

- Snake envenomation cases were seen commonly from rural areas (88.9%). Among cases with GBS significant numbers (75%) were from urban areas. This urban vs rural difference in the etiologies of AFP was statistically significant (p value <0.05).
- 86% of study population had presented with weakness of all four limbs, while 63% and 60% of study population had presented with cranial nerve and respiratory involvement, respectively.
- Cases presenting with fever, altered sensorium, AFP and convulsion were diagnosed to have meningoencephalitis.
- 73% of cases with ascending paralysis had GBS and 60% of patients with simultaneous onset of weakness in the upper and lower limbs had snake envenomation.This pattern of progression of AFP in adults is statistically significant (p value <0.001).
- 100% of snake envenomation cases had ptosis which was statistically significant (p value <0.05).
- B/L 7th cranial nerve involvement was the most common form of cranial nerve involvement in GBS.
- Respiratory involvement was noted most commonly in snake envenomation cases (39%) followed by GBS (29%) and meningo- encephalitis (11%).
- The frequency of GBS variants in our study was AIDP (55%)>AMAN (35%)>AMSAN (10%), which was statistically significant with p value of <0.05.
- CSF analysis in all the cases of GBS showed albuminocytological dissociation. Mean protein levels were higher in AIDP variant of GBS compared to variants with axonal damage.
- 78% cases of Snake envenomation required ventilatory support which was statistically significant (p value <0.05) compared to only 50% cases of GBS requiring the same.
- Total 31.6% cases developed complications during their hospital stay. Most common complication was cardiac arrythmias (27.8%) followed by DVT and Blood stream infection (16.7% each). Others were Bedsores, URTI, aspiration pneumonia, VAP, steroid induced hyperglycemia, Catheter associated UTI, local site infection and ARDS. Complications were more common with PMV.
- Total 59.65% cases recovered completely at discharge, 24.5% improved but had residual deficits, 5.2% had no improvement in muscle power and 10.52% cases died during hospital stay.
- All the cases of the OP poisoning and HP had recovered completely at discharge. 88.9% of the snake envenomation showed similar outcome, while only 40% of the GBS cases had complete recovery at discharge. All cases of polymyositis, LETM, MG, syringomyelia had only partial recovery at the time of discharge.
- Out of 6 (10.5%) cases who died in hospital, 2 had neuroparalytic snakebite, 2 had GBS, and another 2 had meningoencephalitis. Respiratory involvement was present in 100% of the patients who died.

CONCLUSION

- In the absence of fever, bilaterally symmetrical weakness which begins distally and rapidly progresses proximally, with or without sensory involvement points the diagnosis towards the GBS. This pattern with bilateral facial palsy and albuminocytological dissociation on CSF clinches the diagnosis of GBS with utmost certainty.
- Neuroparalytic snake envenomation should be first diagnostic consideration in cases from rural areas in monsoon season with simultaneous upper and lower limb weakness and weakness in the cranial nerve distribution (especially ptosis) at onset, where history of snake bite may or may not be there.
- Measurements of serum potassium levels is an urgent investigation in diagnoses AFP.
- Complete recovery is a rule in Snake envenomation, OP poisoning and Hypokalemic paresis cases if cause is identified emergently and immediate care is provided, whereas greater duration to complete recovery and prolonged mechanical ventilation is common with GBS and Myasthenia gravis.

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How to cite this article:

Harsh N Oza, Devanshee shah and Monila N patel., 2019, Study of 57 Cases of Acute Flaccid Paralysis in a Tertiary care Hospital in India. *Int J Recent Sci Res.* 10(06), pp. 32870-32880. DOI: http://dx.doi.org/10.24327/ijrsr.2019.1006.3559

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