Retrospective, cross-sectional study of the determinants of acute flaccid paralysis among children in Pakistan

Hina Parvaiz[1], Afzal Khan[1] and Saddam Hussain[1]

[1]Medical Teaching Institute, Lady Reading Hospital, Peshawar, Pakistan (Correspondence to Afzal Khan: aqlesaleem63@gmail.com).

Abstract

Background: Timely diagnosis of acute flaccid paralysis is very crucial in developing countries like Pakistan, because this will have significant impact on management.

Aim: To assess the surveillance, aetiology and epidemiology of acute flaccid paralysis in a tertiary care hospital in Peshawar, Pakistan.

Methods: This retrospective, observational study was conducted at the Paediatric Department of Lady Reading Hospital, Peshawar, in 2022. Data on all children aged 1 month to 15 years and diagnosed with acute flaccid paralysis were retrieved from the electronic medical records and patient files of the hospital. The data were analysed using SPSS version 27.

Results: Eighty-eight (1.34%) of the 6544 patients admitted to the paediatric ward met the inclusion criteria for acute flaccid paralysis; 63 (71.6%) of them were male, 25 (28.4%) female, mean age 6.68 ± 3.86 (mean ±SD) years. Guillain Barre Syndrome was diagnosed in 36 (40.9%) of them, meningoencephalitis in 26 (29.5%), septic arthritis in 6 (6.8%), and hypokalaemia paralysis and cerebrovascular accidents in 5 (5.7%). Three (3.4%) of the patients had post-diphtheria neuropathy and 1 (1.1%) had poliomyelitis. In-hospital mortality was 2.3% (2).

Conclusion: Although acute flaccid paralysis is vaccine-preventable and its infectious aetiology is low, its surveillance in Pakistan should be continued to reduce occurrence and progress towards polio eradication.

Key words: acute flaccid paralysis, paediatric, surveillance, aetiology, polio, vaccination, Pakistan

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Introduction

Lower limb weakness, commonly called acute flaccid paralysis (AFP), is an acute onset of flaccid weakness in one or all the limbs among children aged 15 years or less and one of the common clinical presentations for children visiting the paediatric outpatient services (*1,2*). It may be accompanied by bulbar muscle weakness or cranial nerve involvement and often preceded by pain in the affected extremity. In the event of respiratory muscle involvement or autonomic dysfunction, 33% of affected children require management at the intensive care unit (*2*).

The most common cause of acute flaccid paralysis is Guillain Barre Syndrome, an immune-mediated demyelinating disease (*3*). Transverse myelitis is another immune-mediated disorder that causes weakness and loss of sphincter control, and traumatic or compressive spinal lesions and hypokalaemic paralysis should be considered in any acute onset weakness in a child (*4-6*).

Poliomyelitis remains the most debilitating cause of AFP and it is vaccine-preventable. Widespread use of polio vaccine has almost eliminated the disease from the developed countries, however, Pakistan is one of the countries where wild polio virus transmission continues, although considerable reduction in the number of new cases has been reported (*7,8*). One hundred and ninety-eight cases of polio were reported in Pakistan in 2011, a decrease by 12 in the number of cases reported from 6 districts in 2018 (*9,10*). The Pakistani Government and partners are making efforts to ensure complete immunization of children with the help of social mobilizers and religious leaders, but there are concerns about the frequent doses given to children as booster doses, which is required for tropical countries (*11*).

Poliomyelitis is yet to be eradicated from Pakistan and it is associated with many other conditions. Therefore, this study was designed to determine the causes of AFP in Pakistan and assess its surveillance and aetiology in a tertiary care centre. We hope that the study will provide useful information for polio vaccination and eradication and increase the knowledge of paediatricians about the aetiology of AFP.

Operational definitions

Acute flaccid paralysis

Any child aged 1 month to 15 years was considered to have acute flaccid paralysis if they had acute onset weakness in the limb(s) for less than 2 weeks and have at least 2 of the following clinical signs: reduced power (< 5/5) on clinical examination, reduced tone on clinical examination and absent reflexes (*8*).

Pseudoparalysis

A child was considered to have pseudoparalysis if they had weakness in the limb(s), but the cause of weakness is other neuropathic- and myopathic-like pain, arthritis or fracture etc. (12).

Guillain Barre Syndrome

A child was considered to have Guillain Barre Syndrome if they had limb(s) weakness and at least 2 of the following 3 clinical features and the 2 investigation findings: (a) decreased tone, (b) decreased power and (c) diminished or absent (i) protein cell dissociation in cerebrospinal fluid and (ii) nerve conduction deficit on nerve conduction studies (13).

Cerebrovascular accident

A child was considered to have cerebrovascular accident if they had acute neurologic changes which on evaluation was found to have ischemic or haemorrhagic central neurologic insult (14).

Surveillance

If a child, who had weakness of less than 2 weeks duration and admitted to the paediatric unit, was reported to the polio surveillance officer, assessed by the polio team, with their stool collected and sent to laboratory, and a laboratory report was issued, this was considered surveillance (15).

Methods

This was a retrospective, cross-sectional study conducted at Lady Reading Hospital, Peshawar, Pakistan.

The study population included all children aged 1 month to 15 years diagnosed as cases of acute flaccid paralysis at the hospital from 1 January to 31 December 2022. Patients with diseases without weakness such as febrile illness, liver disease, renal disease, blood disorder, etc; those with inability to stand or walk and with clear diagnosis of upper motor neuron diseases such as cerebral palsy, post-meningitic sequelae, neurodegenerative disease; and cases of AFP registered with other institutions were excluded.

Data collection and analysis

Following ethics approval by the Institutional Review Board of the Lady Reading Hospital, the patients' data were collected retrospectively from the electronic database of the hospital, including the presenting complaints, clinical findings, AFP notification, work up performed, diagnosis, and outcome. Investigations conducted for the patients were noted, such as complete blood count, cerebrospinal fluid, stool sample for polio virus, electromyography or nerve conduction study, serum potassium, and magnetic resonance imaging of the brain or spine with or without contrast and ultrasound. No informed consent was needed for the study.

The data were analysed with SPSS version 27 and descriptive analysis were performed for the scale and categorical variables. Cross tabs were performed to assess disease distribution among the age groups and gender.

Results

Eighty-eight of 6544 patients admitted to the Paediatric Department, Lady Reading Hospital, in 2022 presented with acute flaccid paralysis with varying aetiologies (Table 1). Overall prevalence of AFP was 1.34% with 95% confidence interval ± 2.45. The WHO AFP surveillance team was informed about all the cases. Some 29.5% of cases lived in Peshawar while others lived in different areas of Khyber Pakhtunkhwa. Sixty-three (71.6%) of the patients were male and 25 (28.4%) were female, mean age

Table 2 Investigations conducted for acute flaccid paralysis cases, Peshawar, 2022

Variable	Frequency	Percentage
Cerebrospinal fluid		
Normal	18	20.5
Bacterial/viral	24	27.3
Not done	28	31.8
Cytoalbuminologic dissociation	18	20.5
Electromyography nerve conduction study		
Normal	20	22.7
Acute inflammatory demyelinating polyradiculoneuropathy	26	40.9
Acute motor axonal neuropathy	6	6.8
Acute motor and sensory axonal neuropathy	4	4.5
Peripheral polyneuropathy	3	3.4
Sciatic nerve neuropathy	2	2.3
Radial nerve neuropathy	1	1.1
Not done	26	29.5
Magnetic resonance imaging		
Not done	53	60.2
Meningoencephalitis	26	29.5
Ischemia/infarct	5	5.7
Normal	4	4.5
Magnetic resonance imaging spine		
Not done	81	92.0
Transverse myelitis high intensity signals	2	2.3
Normal	5	5.7
Total leucocyte blood		
Normal	54	61.4
High	34	38.6
Serum potassium		
Normal	83	94.3
Low	5	5.7
Local ultrasound		
Not done	81	92.0
Abnormal fluid or pus collection	7	8.0

Figure 1 Age and gender distribution, acute flaccid paralysis cases (<5-year-olds), Peshawar, 2022

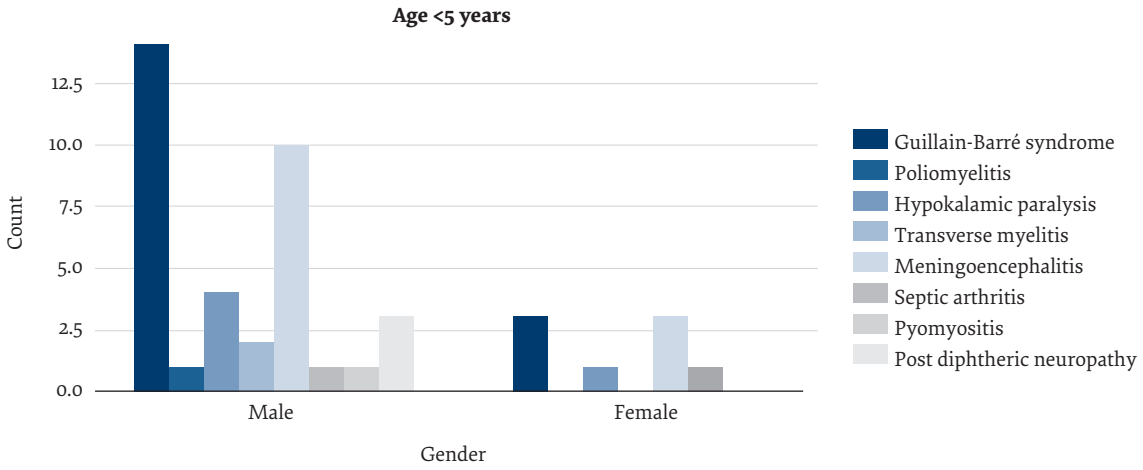

Figure 2 Age and gender distribution, acute flaccid paralysis cases (5–10-year-olds), Peshawar, 2022

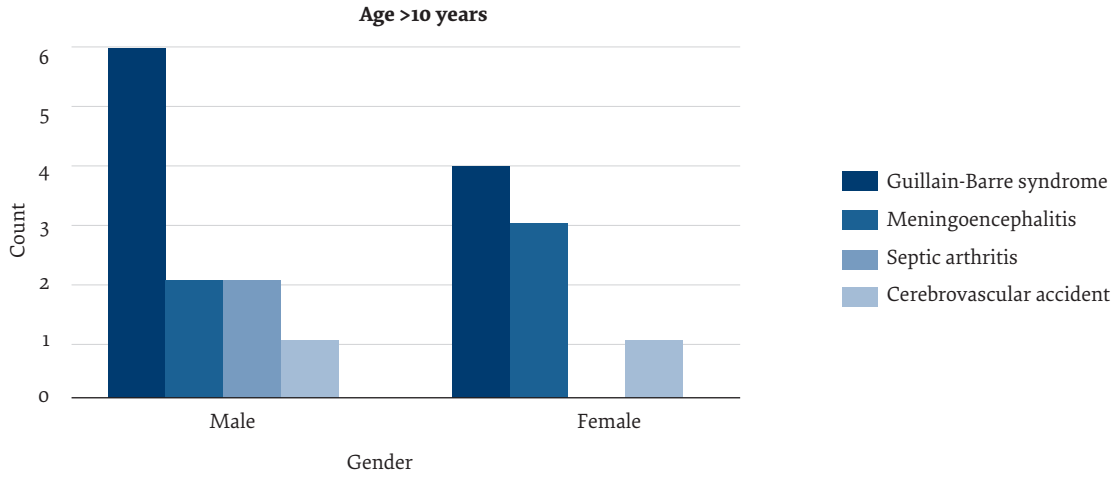

Figure 3 Age and gender distribution, acute flaccid paralysis cases (>10-year-olds), Peshawar, 2022

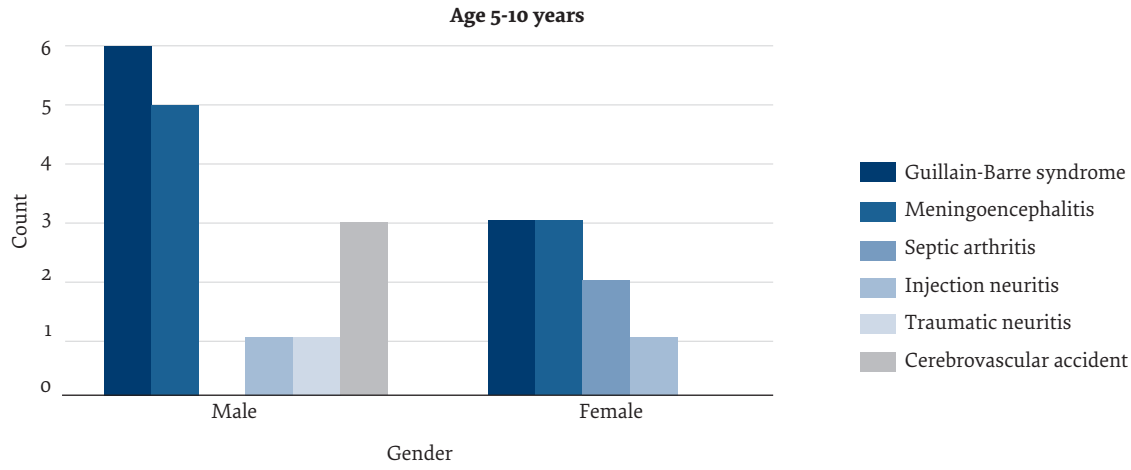

Table 1 **Causes of acute flaccid paralysis, Peshawar, 2022**

Diagnosis	Frequency	Percentage
Guillain Barre syndrome	36	40.9
Poliomyelitis	1	1.1
Hypokalaemic periodic paralysis	5	5.7
Transverse myelitis	2	2.3
Meningoencephalitis	26	29.5
Septic arthritis	6	6.8
Pyomyositis	1	1.1
Injection neuritis	2	2.3
Traumatic neuritis	1	1.1
Cerebrovascular accident	5	5.7
Post-diphtheria neuropathy	3	3.4

6.68 ± 3.86 (mean ± SD) (Figure 1). Children <5 years were 50%, 5–10 years 28.4% and more than 10 years 21.6%.

Guillain Barre syndrome was the most common (40.9% of cases) among all the causes of AFP (Table 1). Among children diagnosed with Guillain Barre syndrome, 72.2% were male and 27.8% were female; 47.2% of these were <5 years, 25% were 5–10 years and 27.8% were >10 years. Two of the patients with Guillain Barre syndrome required intensive care unit admission. Children with meningoencephalitis were 29.5% of cases and half of them were <5 years, 76.9% were male and 23.1% were female.

Of all the cases, 5.7% had cerebrovascular accident; 60% of them were 5–10 years, 40% >10 years and 8% were male. One patient with cerebrovascular accident and another with meningoencephalitis, both males and aged >5 years died.

Hypokalaemia paralysis, transverse myelitis and post-diphtheric neuropathy was observed among children aged <5 years (Figures 1,2,3). One male child had traumatic neuritis, while septic arthritis was equally prevalent among all age groups.

One case of poliomyelitis from Lakki Marwat District and aged 1 year was confirmed through positive stool test. This patient needed intensive care unit admission, had a prolonged hospital stay, survived but had disability, and not able to stand and walk.

Patients with Guillain Barre syndrome were mainly diagnosed through nerve conduction studies and mostly reported as acute inflammatory demyelinating polyradiculoneuropathy, acute motor axonal neuropathy or acute motor and sensory axonal neuropathy. Cerebrospinal fluid analysis was either normal or showed cytoalbuminologic dissociation.

Table 2 presents the investigations conducted and the findings. Meningoencephalitis cases showed either viral or bacterial infection on cerebrospinal fluid, and brain imaging revealed encephalitis or meningoencephalitis. Transverse myelitis diagnosis was made on magnetic resonance imaging of the spinal cord showing high intensity signals. One child had trauma to the left arm and nerve conduction study consistent with radial nerve injury, suggestive of traumatic neuritis. Some 5.7% of the children had hypokalaemic paralysis while the rest of their investigations were normal. These children improved after potassium supplementation and with improvement of underlying illness. Ultrasound showed fluid or pus collection in the hip joints for children with septic arthritis. Children diagnosed with post-diphtheria had history of whitish throat membrane and had bulbar palsy preceding the limb weakness; nerve conduction studies showed that they had peripheral polyneuropathies.

Discussion

Acute flaccid paralysis is a common diagnosis among paediatric patients hospitalized in tertiary care centres and sometimes requires prolonged hospital stay (*16*). Its aetiologies are varied, and the cause can be neurologic or non-neurologic (*17*). Among the aetiologies, poliomyelitis is considered important epidemiologically because it is preventable and has been eradicated in most parts of the world (*18*). Early diagnosis of AFP cases and timely reporting for surveillance and aetiologic classification have significant impact on disease outcome (*19*).

In our study, 88 (1.34%) of 6544 admitted patients had AFP. Out of these 88 patients, 76 were caused by neurologic lower limb weakness while 12 were caused by non-neurological aetiology. Among the neurological cases, 45 had true AFP: Gillian Barre syndrome 36 cases, post-diphtheria neuropathy 3 cases, transverse myelitis and injection neuritis 2 cases each, and traumatic neuritis and poliomyelitis one case each. Among the neurologic causes, 31 were not true AFP (pseudoparalysis) because they had diseases involving the central nervous system (meningoencephalitis and cerebrovascular accident) and had initially presented with flaccid paralysis. Among the non-neurologic cases, 6 were of musculoskeletal cause and had septic arthritis while 5 had biochemical disturbance and hypokalaemic paralysis. One patient was diagnosed with pyomyositis.

In our study, 63 (71.6 %) of the patients were male and 25 (28.4%) were female. Kulkarni et al reported 33 (55%) male and 27 (45%) female in a study of 60 patients (*19*), mean age 5.75 ± 3.5 years. Half of the children in our study were <5 years, 28.4% were 5–10 years and 21.6% were >10 years (Figures 1,2,3). Ahmad et al found mean age 4.1 years and majority (72.6%) in the 0–5 years age group among 73 cases, suggesting male predominance (*20*).

Guillain Barre syndrome is a high-risk low prevalence disease and the most common aetiology of AFP (*21*). It constituted the larger part of our study (36 cases, 40.9%) and 40% of these required intensive care unit admission and received conservative treatment, intravenous immunoglobulin and/or plasmapheresis. Ahad Ghazvi et al described a larger number of patients with Guillain Barre syndrome with inability to walk as the prominent clinical feature (*22*). Kulkarni et al found 41.6% Guillain Barre syndrome, followed by stroke (18%), encephalitis (17%), space occupying lesion (8%), tuberculous meningitis

(7%), Bell's palsy (3%), transient ischemic attack (3%), and acute disseminated encephalomyelitis (2%) in a prospective and outcome study (*19*). We found similar neurologic causes of weakness in our study, except biochemical disturbance, which they did not report, in addition to vaccine preventable diseases, which was low in frequency in our study. Rhandhawa et al described the clinical findings in children with Guillain Barre syndrome who required mechanical ventilation and Sher et al reported comparable Guillain Barre syndrome frequency of 45% among children with AFP (*23,24*).

Post-diphthaeric neuropathy was the cause of AFP in 3 cases in our study, also reported by Sher et al and Kulkarni et al in (*19,24*). Vykuntaraju et al reported that 38% of their patients with diphtheria developed neurological complications (*25*).

We found 2 cases of transverse myelitis, an uncommon aetiology of AFP, which was not reported by many authors, although Celik et al described 15 cases in their 10-year study (*26*). We found 2 cases of injection neuritis and 1 case of traumatic neuritis in our study, which is also uncommon in most available literature but reported by Akhlaque et al in a 3-year study (*27*).

Poliomyelitis is no longer common globally because of the successful vaccination and surveillance programme coordinated by WHO. However, we found 1 case in our study, which is of epidemiologic significance.

In our study meningoencephalitis was the most common cause of pseudoparalysis (not true AFP) in 26 patients and cerebrovascular accident in 5 patients, followed by septic arthritis and pyomyositis. Madaan et al reported these aetiologies as the cause of pseudoparalysis, while Gupta et al from north India reported that Guillain Barre syndrome was the cause of AFP in 50.5% of 97 patients, and hypokalaemic paralysis 25.8%, of which 52% were hypokalaemia periodic paralysis and 48% were from secondary causes (*28,29*). The second most common cause of AFP in the Gupta et al study was neuroparalytic snake bite (15.5%), which is different from our study.

All patients who presented with AFP in our study were reported to WHO surveillance team for polio virus detection in stool sample. Abdel-Fattah et al reported good surveillance in Egypt; 98% of cases were notified within 7 days of onset of the disease and investigated within 48 hours (*30*). It is worth mentioning that our study was conducted in a tertiary care hospital of a province where education status, awareness about vaccination and accessibility to health facility is high, hence the 100% surveillance.

A previous departmental record for the 2 years (2020 and 2021) preceding our study showed 117 AFP cases, of which 41 were meningoencephalitis, 39 Guillain Barre syndrome, 8 post-diphtheric neuropathy, 7 cerebrovascular accident, 5 septic arthritis, 5 pyomyositis, 3 viral myositis, 3 autoimmune encephalitis, 2 transient synovitis, 2 transverse myelitis, 1 Todd's paralysis, and 1 neuroblastoma. Male were 79 and female 38 and mean age was 6.05 ± 3.56 years.

Two (2.27%) patients in our study died in the hospital; 1 diagnosed with meningoencephalitis and 1 with cerebrovascular accident. Kulkarni et al reported 11 (18%) deaths (*19*). This high mortality was likely due to severe disease (quadriparesis and cranial nerves involvement), we however did not study these predictors.

Conclusion

Acute flaccid paralysis has a vast aetiologic spectrum. It can be caused by disease of the peripheral nervous system (true AFP) and central nervous system (pseudoparalysis) and by musculoskeletal and biochemical disorders. Apart from notification, any suspected AFP case should be evaluated in detail to reach the right diagnosis and offer appropriate treatment. Most of our cases were among children less than 5 years of age. Although AFP is vaccine-preventable and its infectious aetiology is low, its surveillance in Pakistan should be continued to reduce occurrence and progress towards polio eradication.

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Competing interests: None declared.

Étude rétrospective transversale des déterminants de la paralysie flasque aiguë chez les enfants au Pakistan

Résumé

Contexte : Le diagnostic précoce de la paralysie flasque aiguë est très important dans les pays en développement comme le Pakistan, puisqu'il aura un impact important sur la prise en charge.

Objectif : Évaluer la surveillance, l'étiologie et l'épidémiologie de la paralysie flasque aiguë dans un hôpital de soins tertiaires à Peshawar (Pakistan).

Méthodes : La présente étude rétrospective observationnelle a été réalisée au département de pédiatrie de l'hôpital Lady Reading, à Peshawar, en 2022. Les données relatives à tous les enfants âgés entre un mois et 15 ans et diagnostiqués avec une paralysie flasque aiguë ont été extraites des dossiers médicaux électroniques et des dossiers des patients de l'hôpital. Elles ont été analysées à l'aide du logiciel SPSS version 27.

Résultats : Quatre-vingt-huit (1,34 %) des 6544 patients admis au service de pédiatrie répondaient aux critères d'inclusion pour la paralysie flasque aiguë ; 63 (71,6 %) étaient des garçons, 25 (28,4 %) des filles, avec un âge moyen de 6,68 ans ± 3,86 (moyenne ± écart-type). Un syndrome de Guillain-Barré a été diagnostiqué

chez 36 (40,9 %) d'entre eux, une méningo-encéphalite chez 26 (29,5 %), une arthrite septique chez six (6,8 %) et une paralysie hypokaliémique et des accidents vasculaires cérébraux chez cinq (5,7 %). Trois (3,4 %) des patients présentaient une neuropathie post-diphtérique et un patient (1,1 %) une poliomyélite. La mortalité hospitalière était de 2,3 % (deux patients).

Conclusion : Bien que la paralysie flasque aiguë soit une maladie évitable par la vaccination et que son étiologie infectieuse soit faible, sa surveillance au Pakistan doit être poursuivie pour réduire son occurrence et progresser sur la voie de l'éradication de la poliomyélite.

دراسة اسْتِعَادِيَّة مقطعية لمُحدِّدات الشلل الرخو الحاد في صفوف الأطفال في باكستان

هينا برفيز، أفضال خان، صدام حسين

الخلاصة

الخلفية: يعد تشخيص الشلل الرخو الحاد في الوقت المناسب أمرًا بالغ الأهمية في البلدان النامية مثل باكستان، لما له تأثير كبير على التدبير العلاجي.

الأهداف: هدفت هذه الدراسة الى تقييم ترصُّد الشلل الرخو الحاد ومسبباته وخصائصه الوبائية في أحد مستشفيات الرعاية الثالثية في مدينة بيشاور، باكستان.

طرق البحث: أُجريت هذه الدراسة الرصدية الاسْتِعَادِيَّة في قسم طب الأطفال في مستشفى ليدي ريدينج بمدينة بيشاور في عام 2022. واستُرجعت بيانات جميع الأطفال الذين تراوحت أعمارهم بين شهر واحد و15 عامًا، والمُشخَّصة إصابتهم بالشلل الرخو الحاد من السجلات الطبية الإلكترونية وملفات المرضى بالمستشفى. وخضعت البيانات للتحليل بالإصدار 27 من برنامج SPSS.

النتائج: استوفى ثمانيةٌ وثمانون طفلاً مريضًا (1.34%) من أصل 6544 مريضًا أُدخلوا إلى جناح طب الأطفال معاييرَ الإدراج فيما يتعلق بالشلل الرخو الحاد؛ وكان 63 مريضًا (71.6%) منهم من الذكور، و25 مريضة (28.4%) من الإناث، وبلغ متوسط العمر 6.68 ± 3.86 أعوام (متوسط ± الانحراف المعياري). وشُخِّصت 36 حالة (40.9%) منهم بمُتلازمة جيَّان باريه، و26 حالة (29.5%) بالتهاب السَّحَايَا وَالدماغ، و6 حالات (6.8%) بالتهاب المفاصل الإنتاني، و5 حالات (5.7%) بشلل نقص البوتاسيوم والحوادث الوعائيَّة الدماغيَّة. وكان قد أُصيب ثلاثة مرضى (3.4%) باعتلال عصبي تالٍ لمرض الدفتيريا، ومريض واحد (1.1%) بشلل الأطفال. وبلغ عدد الوفيَات في المَستشفى حالتيْ وفاة (2.3%).

الاستنتاجات: رغم أنَّ الشلل الرخو الحاد يمكن الوقاية منه باللقاحات، ومسبباته المُعْدية منخفضة، ينبغي مواصلة ترصُّده في باكستان للحد من حدوثه وتحقيق التقدم نحو استئصال شلل الأطفال.

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