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Clinical Spectrum & Short-Term Treatment Outcome of Rasmussen Encephalitis in 15 Patients in a Tertiary Care Hospital of Bangladesh

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Abstract

Background: Rasmussen encephalitis (RE) is a chronic, progressive encephalitis affecting one hemisphere of the brain. Intractable focal seizures, progressive neurological & cognitive decline and hemispheric atrophy are common clinical and radiological presentations of the disease. ***Objective:*** To see the clinical spectrum & short-term treatment outcome of Rasmussen Encephalitis. ***Method:*** It was a prospective interventional study, conducted at Department of Pediatric Neurology, Bangabandhu Sheikh Mujib Medical University, Dhaka from July 2022 to July 2023. Total 15 patients with Rasmussen encephalitis were evaluated after IV Methylprednisolone therapy at the doses of 20-30 mg/kg/day. ***Results:*** Among 15 patients, 8 (53.3%) were aged 5–10 years and 7 (46.7%) were <5 years; males predominated (11, 73.3%). All presented with seizures, hemiparesis, neuroregression, and cognitive impairment. Dysarthria was observed in 10 (66.7%) and facial nerve palsy in 4 (26.7%). Focal seizures were most common (7, 46.7%), followed by generalized tonic–clonic seizures (3, 20%). EEG showed unihemispheric slowing in 12 (80%) and generalized slowing in 3 (20%). Neuroimaging revealed unihemispheric insular–perisylvian atrophy with basal ganglia involvement in all cases. Following IV methylprednisolone, seizure frequency improved in 13 (86.7%) and EEG improved in 8 (53.3%). ***Conclusion:*** All patients with Rasmussen encephalitis presented with seizure, hemiparesis, neuroregression & cognitive impairment. IV Pulse methylprednisolone therapy were effective where seizure frequency reduced more than three-fourth cases & electroencephalographical improvement occured more than half of the cases of all Rasmussen encephalitis.

Keywords: Clinical spectrum, Treatment outcome, Rasmussen encephalitis, Bangladesh, Neurology.

INTRODUCTION

Rasmussen encephalitis (RE), also known as Rasmussen syndrome, is a rare, chronic, progressive encephalitis that affects one cerebral hemisphere, causing intractable focal seizures, neurological deterioration, and cognitive decline [1,2]. The disease, first described by Theodore Rasmussen and colleagues in the 1950s, most commonly affects children and young adults, with an incidence of 1.7–2.4 per 10 million individuals under 18 years, peaking around six years of age [3,4]. Although primarily a pediatric condition, approximately 10% of cases occur in adolescents and adults. Clinically, RE progresses through three phases: a prodromal stage with infrequent seizures, an active stage characterized by epilepsia partialis continua and progressive hemiparesis, and a residual stage marked by fixed deficits and reduced seizure frequency if untreated [5]. The predominant seizure type is epilepsia partialis continua, while refractory focal status epilepticus and occasional movement disorders such as dystonia or chorea may also occur [6].

The etiology of RE remains uncertain, though evidence supports an immune-mediated mechanism. Histopathological findings and partial responses to immunomodulatory therapy further substantiate this hypothesis [7]. Diagnosis relies on a combination of clinical, electrophysiological, and neuroimaging criteria. The European Consensus Statement defines diagnostic

features based on focal seizures with unilateral cortical deficits, unihemispheric slowing on EEG, and progressive cortical atrophy with signal changes on MRI [8] (Table 1).

Table 1: Diagnostic Criteria of Rasmussen's encephalitis

Part A	
1. Clinical	Focal seizures (with or without Epileptia partialis continua) and Unilateral cortical deficit
2 EEG	Unihemispheric slowing with or without epileptiform activity and Unilateral seizure onset
3. MRI	Unihemispheric focal cortical atrophy and at least one of the following--- • Grey or white matter T2/FLAIR hyperintense signal • Hyperintense signal or atrophy of the ipsilateral caudate head
Part B	
1. Clinical	Epileptia Partialis Continua or Progressive unilateral cortical deficits
2. MRI	Progressive unihemispheric focal cortical atrophy
3. Histopathology	T cell dominated encephalitis with activated microglial cells (typically, but not necessarily forming nodules and reactive astrogliosis
Note: RE can be diagnosed if either all three criteria of Part A or two out of three criteria of Part B are present (Bien *et al.*, 2005).	

Surgical management such as hemispherectomy or hemispherotomy remains the most definitive therapy for drug-resistant cases, though such interventions are restricted to patients with established contralateral motor deficits. In resource-limited settings where epilepsy surgery is unavailable, immunotherapy with corticosteroids, intravenous immunoglobulin, or plasma exchange remains the primary treatment modality [7].

As RE is an uncommon entity, local data remain limited, and its clinical profile and therapeutic outcomes are not well documented in Bangladesh. This study aims to present clinical characteristics, demographic distribution, and treatment responses to high-dose intravenous methylprednisolone among 15 children diagnosed with Rasmussen encephalitis in a tertiary care hospital in Dhaka.

MATERIALS AND METHODS

The study was conducted in the Department of Pediatric Neurology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh. A total of 15 children admitted with a diagnosis of Rasmussen's Encephalitis (RE) between July 2022 and July 2023 were included. Data were collected from both retrospectively and prospectively admitted patients during this period. The diagnosis of RE was established based on the European Consensus Statement diagnostic criteria (Table 1). All patients who fulfilled the diagnostic criteria of RE were included in the study. Patients with alternative diagnoses or incomplete clinical and radiological data were excluded.

Detailed clinical and demographic data were recorded for each participant, including age, sex, birth and developmental history, perinatal events, antecedent illnesses, and seizure characteristics such as age at onset, type of seizures, and the presence of epilepsia partialis continua. Comprehensive neurological and neuroradiological evaluations were performed in all patients before initiation of corticosteroid therapy. Following baseline evaluation, each patient received pulse intravenous methylprednisolone at a dose of 20–30 mg/kg/day for five consecutive days monthly, continued for five months. Clinical and electrophysiological improvements were assessed prospectively after therapy.

All data were collected using a predesigned structured questionnaire. Informed written consent was obtained from parents or legal guardians prior to inclusion in the study. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 24.

RESULT

A total of 15 children diagnosed with Rasmussen's Encephalitis were included in this study. The mean age of the participants was predominantly between 5 to 10 years, accounting for 8 (53.33%) of the cases, while the remaining 7 (46.66%) were below 5 years of age. There were 11 (73.33%) males and 4 (26.66%) females. Most of the patients, 10 (66.67%), were from rural areas, and more than half, 8 (53.33%), belonged to lower socioeconomic status. Consanguinity was reported in 2 (13.33%) patients, and 1 (6.67%) patient had a positive family history of epilepsy. All patients had normal developmental milestones prior to disease onset. The majority, 10 (66.67%), developed seizures and hemiparesis before 5 years of age (Table 2). Clinically, all 15 (100%) patients presented with seizures, hemiparesis, neuroregression, and cognitive impairment. Dysarthria or dysphasia was noted in 10 (66.67%) cases, cranial nerve involvement (mainly facial nerve palsy) in 4 (26.66%) patients, and behavioral abnormalities such as hyperactivity in 8 (53.33%) patients. Additionally, visual impairment was observed in 2 (13.33%) cases, while dystonia occurred in 1 (6.67%) patient (Table 3).

Regarding seizure characteristics and electroencephalographic (EEG) findings, focal seizures were the most frequent type, seen in 7 (46.66%) patients, followed by generalized tonic–clonic seizures and

convulsive status epilepticus, each occurring in 3 (20%) cases. Epilepsia partialis continua was observed in 2 (13.33%) patients. Seizure frequency was <10 episodes per day in 9 (60%) patients, while 6 (40%) experienced ≥10 episodes daily, with most seizures lasting less than 5 minutes in 11 (73.33%) patients. EEG showed abnormal background activity in all patients, predominantly unihemispheric slowing in 12 (80%) cases. Focal epileptiform discharges were the most common interictal finding (60%), followed by generalized spike-wave discharges (26.66%) and burst suppression pattern (13.33%) (Table 4). Neuroimaging findings revealed that all patients (100%) had unihemispheric insular and perisylvian atrophy with basal ganglia involvement. Caudate atrophy was most frequent (60%), and unilateral white matter hyperintensities were noted in 11 (73.33%) cases. Brainstem atrophy was present in 2 (13.33%) patients (Table 5). Following intravenous methylprednisolone therapy, 13 (86.66%) patients showed partial (>50%) improvement in seizure frequency, and 8 (53.33%) showed partial EEG improvement, while no patient experienced worsening of symptoms.

Table 2: Baseline characteristics of study population (n=15)

Variable	Number	Frequency (%)
Age		
<5 year	7	46.66
5-10 year	8	53.33
>10 year	0	0
Sex		
Male	11	73.33
Female	4	26.66
Residence		
Rural	10	66.67
Urban	5	33.33
Social Class		
Lower	8	53.33
Middle	4	26.67
Upper	3	20
Family history		
Consanguinity	2	13.33
Epilepsy	1	6.67
Sib death	0	00
Birth History		
Preterm	0	00
H/O Perinatal Asphyxia	1	6.67
Neonatal Jaundice	0	00
Sepsis	0	00
Development history		
Normal	15	100
Delayed	0	0
Age of onset of seizures		
<5 year	10	66.67
5-10 year	5	33.33
>10 year	0	0
Age of onset of hemiparesis		
<5 year	10	66.67
5-10 year	5	33.33
>10 year	0	0

Table 3: Distribution of study populations by Clinical presentation (n=15)

Presentation	Number	Frequency (%)
Seizures	15	100
Hemiparesis	15	100
Neuroregression	15	100
Learning disability/ ID/ cognitive impairment	15	100
Dysarthria/Dysphasia	10	66.67
Cranial nerve involvement	4	26.66

Presentation	Number	Frequency (%)
Behavior abnormality	8	53.33
Visual impairment	2	13.33
Dystonia	1	6.67

Table 4: Pattern of seizures and of EEG at presentation (n=15)

	Number	Frequency
Type of seizure		
Epilepsia Partialis Continua	2	13.33
Focal Seizure	7	46.66
Generalized tonic-clonic seizures	3	20
Convulsive status epilepticus	3	20
Seizure per day		
<10 times/day	9	60
≥10 times/day	6	40
Duration of seizure		
<5 min	11	73.33
>5 min	4	26.67
Pattern of EEG changes		
Generalized Spike wave discharge	4	26.66
Focal epileptiform discharge	9	60
Burst suppression pattern	2	13.33

Table 5: Distribution of study populations by Neuroimaging changes (n=15)

Neuroimaging (MRI of brain)	Number	Frequency (%)
Normal	0	0
Abnormal		
Unihemispheric Insular and perisylvian atrophy& basal ganglia involvement	15	100
Basal ganglia involvement		
Only Caudate atrophy	9	60
Caudate & putaminal atrophy	5	33.33
CaudaCaudate, putaminal & globus pallidal atrophy	1	6.66
White matter hyperintense signal changes	11	73.33
Atrophy of cerebral peduncle and brainstem	2	13.33

Table 6: Individual IV Methylprednisolone treatment response

Treatment outcome	Number	Frequency (%)
1. Outcome of Seizure frequency after IV MP		
No response (Unchanged)	2	13.33
Partially Improved (>50%)	13	86.66
Worsened	0	0
2. Outcome of EEG after IV MP		
No response (Unchanged)	7	46.67
Partially Improved (>50%)	8	53.33
Worsened	0	0

DISCUSSION

Rasmussen encephalitis (RE) is a rare, progressive neurological disorder involving chronic inflammation confined to one cerebral hemisphere, leading to intractable epilepsy, cognitive decline, and hemiparesis [9]. In this study, we analyzed the clinical characteristics and short-term response to immunotherapy in 15 pediatric patients diagnosed with RE. The majority of patients were male and developed seizures and hemiparesis before the age of five, consistent with earlier reports indicating peak onset between five and six years of age [10,11]. Although previous studies suggest no sex or ethnic predominance [12], our male predominance likely reflects sampling variation.

RE pathogenesis remains incompletely understood. Proposed mechanisms include direct viral infection, autoimmune activation triggered by viral antigens, or a primary autoimmune process [13]. Histopathological and immunologic evidence supports an immune-mediated mechanism involving cytotoxic T-cell activation and limited B-cell response [14]. Autoantibodies against glutamate receptor GluR3 have

been reported in some patients [15], though not universally confirmed. Recently, dual pathologies such as focal cortical dysplasia or ischemic lesions have been described, suggesting possible coexistence of structural and immunological injury [16,17].

Clinically, most patients present with drug-resistant focal seizures, which may progress to epilepsia partialis continua, followed by unilateral weakness and cognitive regression. In our series, all children exhibited seizures, hemiparesis, and cognitive impairment, consistent with other studies [11,18]. Although uncommon, we observed atypical manifestations such as behavioral changes, dystonia, and cranial nerve involvement, as previously described [19]. Progressive neurological decline, especially cognitive and language impairment, often parallels hemispheric involvement. Rudebeck *et al.,* reported that left-hemispheric disease causes verbal deficits, whereas right-sided lesions predominantly affect visuospatial function [20] — consistent with our patients who developed dysphasia due to left-sided disease.

RE typically evolves through three stages: a prodromal stage with infrequent seizures, an acute stage characterized by EPC and rapid hemiparesis, and a residual stage marked by stable neurological deficits [5,21]. Most of our patients followed a similar course, though the duration of each phase varied. Neuroimaging plays a critical role in diagnosis. Early MRI may appear normal, but progressive unilateral cortical atrophy, T2/FLAIR hyperintensity, and insular or perisylvian involvement are characteristic [22]. Bien *et al.,* proposed a five-stage MRI evolution model, progressing from early cortical swelling to established hemispheric atrophy [23]. In our study, all patients demonstrated unihemispheric cortical atrophy with basal ganglia involvement, similar to prior findings [24].

EEG findings are equally important but nonspecific. Early EEG may show focal slowing that gradually spreads to involve one or both hemispheres with marked asymmetry [12,22]. Interictal abnormalities such as focal spikes, generalized spike-wave discharges, or burst-suppression patterns often correlate with disease severity [25]. In our cohort, all patients exhibited abnormal EEGs with unilateral slowing and epileptiform discharges, supporting these observations.

Histopathology remains the diagnostic gold standard, typically showing T-cell-dominated encephalitis with microglial nodules and reactive astrogliosis [26]. However, histopathological confirmation was unavailable in our center due to technical constraints.

Management of RE aims to control seizures and halt neurological deterioration [27]. Although antiepileptic drugs (AEDs) are used extensively, they rarely achieve seizure freedom and primarily serve to reduce seizure burden [28]. Consistent with earlier reports, none of our patients achieved complete seizure control despite multiple AED combinations. Given the immune-mediated pathogenesis, various immunotherapies have been trialed, including high-dose corticosteroids, intravenous immunoglobulin, plasma exchange, and immunosuppressants such as tacrolimus or rituximab [7,29]. In our series, only high-dose intravenous methylprednisolone was used, followed by short-term oral steroids in selected cases.

Evidence suggests that early initiation of immunotherapy may slow progression and improve outcomes [30,31]. Granata *et al.,* and Papetti *et al.,* emphasized that timely intervention with steroids or IVIG can delay hemispheric deterioration and reduce seizure frequency [32,33]. Similarly, Bien *et al.,* demonstrated favorable outcomes with tacrolimus, while Bahi-Buisson *et al.,* reported >50% seizure reduction in most children treated with steroids, though relapse may occur [34,35]. Our findings align with these observations: 86.6% of patients showed >50% reduction in seizure frequency, and 53.3% exhibited EEG improvement after immunotherapy, though none achieved seizure freedom.

Other treatment modalities such as vagus nerve stimulation, transcranial magnetic stimulation, and botulinum toxin for EPC have been reported but were not used in our study due to financial and logistic limitations [36,38]. Surgical interventions, including hemispherectomy or hemispherotomy, remain the most definitive therapy and can prevent further cognitive decline when performed early [39,40]. However, due to limited facilities, none of our patients underwent surgery.

Overall, our results reaffirm that immunotherapy, particularly corticosteroids, may provide symptomatic benefit and delay progression but seldom achieves complete remission [41]. Early diagnosis, multidisciplinary management, and timely surgical evaluation remain essential for optimal outcomes.

Study Limitation

This study was limited by its small sample size, single-center design, and lack of histopathological and immunological confirmation due to resource constraints. Long-term follow-up was not performed, restricting assessment of sustained treatment outcomes. Despite these limitations, the study provides valuable preliminary data on Rasmussen encephalitis in Bangladeshi children.

CONCLUSION

The study showed all patients with Rasmussen encephalitis presented with seizure, hemiparesis, neuroregression & cognitive impairment. IV Pulse methylprednisolone therapy were effective where seizure frequency reduced more than three-fourth cases &

electroencephalographically improvement occurred more than half of the cases of all Rasmussen encephalitis.

Conflict of Interest: There was no conflict of interest.

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Author Contributions
Conceive and Study Design and Data Analysis: Prof. Dr. Gopen Kumar
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