Benign Acute Childhood Myositis: A Benign Disease that Mimics More Severe Neuromuscular Disorder

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Context: Proximal lower limb weakness presenting acutely with or without preceding fever is a strong mimic of Guillain–Barré syndrome (GBS). Benign acute childhood myositis (BACM) forms an important differential diagnosis in such cases. Aim: To characterize the clinical and laboratory findings of patients with BACM for better understanding of the disease. Settings and Design: This prospective longitudinal study was conducted in a tertiary care hospital of northern India. Materials and Methods: Thirty-two patients presenting in the outpatient or emergency clinic of the hospital with severe myalgia that exacerbated with straight leg raising test and fever from July 2016 to July 2017 were included in the study. Statistical Analysis: All the continuous data were expressed as number and percentage or mean ± standard deviation/median. Non-parametric continuous data between groups were analyzed by Friedman’s test. Results: The mean age of the patients was 14.3 (±8.7) years and they presented after a nonspecific febrile illness in most of the cases (53.1%). The symptoms resolved after a mean of 5.7 (±1.6) days. Myalgia was present in 21 (65%) cases, whereas proximal weakness was the prominent finding in 14 (43%) cases. Electrolyte abnormality (hypokalemia) was present in four (12.5%) cases. In all patients, the muscle enzymes (creatine phosphokinase, serum glutamic oxaloacetic transaminase, serum glutamic pyruvic transaminase, and lactate dehydrogenase) were elevated at presentation, and electromyography showed myopathic pattern. A significant recovery took place in the next 5–7 days. Conclusion: BACM should be actively looked for in cases of painful acute proximal limb weakness in the adolescents.

Keywords: Benign, creatine phosphokinase, electromyography, myositis

Introduction

Weakness following suspected viral fever is a common finding. The causes may be many, common ones being benign focal inflammation of muscle such as viral myositis, repolarization defects of muscle and nerve because of hypokalemia precipitated by fever, or more catastrophic diseases such as Guillain–Barré syndrome (GBS). GBS remains the most common referral diagnosis of weakness occurring within the 1st week of viral fever to a tertiary care hospital.[1] It is characterized by progressive weakness of arms, legs, and cranial nerves with limb paresthesia, occasionally complicated in many cases by severe radicular pain. Autonomic disturbance and ventilator requirement in one-third of the hospitalized patients makes it a disease that should be managed in a referral center.[2] However, weakness because of hypokalemia and post-viral myositis are benign disorders, which can be managed in relatively smaller settings with fewer investigations such as serum potassium and creatine phosphokinase levels (CPK) and supportive treatment. Lundberg[3] initially described the entity of benign acute childhood myositis (BACM) under the name “Myalgia Cruris Epidemica” in 1957. He described it as a disease
affecting mainly children with acute-onset calf pain and refusal to walk after an episode of suspected viral fever. We report 32 such cases from a tertiary care center of North India with their clinical and laboratory features along with a literature review of this disease.

**Materials and Methods**

This study was carried out in 32 patients presenting to the outpatient department/emergency clinic fulfilling the inclusion criteria from July 2016 to July 2017.

**Inclusion criteria:** All patients presenting acutely with fever, myalgia (exacerbated by straight leg raising test), weakness, and muscle tenderness.

**Exclusion criteria:**

1. Presence of headache, vomiting, and altered sensorium
2. Persistent focal deficits

Complete clinical and neurological examination of the patients was carried out after admission. Laboratory parameters such as routine hematological tests; liver and renal function tests (which included serum glutamic oxaloacetic transaminase [SGOT], serum glutamic pyruvic transaminase [SGPT], lactate dehydrogenase [LDH], CPK); serological tests for dengue, influenza, leptospira, cytomegalovirus, scrub typhus, and mycoplasma; urine analysis (routine, microscopy, and myoglobin analysis); X-ray chest; and electrocardiogram were carried out. Nerve conduction studies of common peroneal, median, and sural nerves were performed and if normal, electromyography of quadriceps was carried out in all patients.

All the patients were followed up till recovery and discharged with serial monitoring of CPK, SGOT, SGPT, LDH, and platelet levels every alternate day.

**Ethical clearance**

This project has been cleared from the Institutional Ethics Committee, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, Uttar Pradesh, India; IEC code (2016-07-IP-89). Consent was obtained from every patient in the prespecified pro forma before enrollment.

**Statistical analysis**

All the continuous data were expressed as number and percentage or mean ± standard deviation (SD)/median. Non-parametric continuous data between groups were analyzed by Friedman’s test. A p value of <0.05 was considered as significant.

**Results**

Thirty-two patients fulfilled the inclusion criteria during the study of 12 months. Approximately 90% of them were males [Table 1]. Age group varied from 6 to 54 years with mean age of 14.3 years and median age of 12 years. The symptoms were present for a mean of 3.7 days (range, from 1 to 6 days) before presentation to the tertiary care facility [Figure 1]. Respiratory prodrome was present in 37% cases, whereas diarrheal in 9%. Most of the cases (53%) had non-specific febrile illness without any specific focus. Muscle pain was present in the calves, which exacerbated on straight leg rising test in more than half of the cases (65%), whereas proximal weakness in both upper and lower limbs was present in 43% cases. One patient had severe weakness in the form of quadripareisis, whereas another one had only cramps without any weakness. Ambulatory patients (78%) formed the majority of the cohort. Most of the cases occurred in the month of July and August [Figure 2].

| Parameters | Number (Percent)/Mean±SD |
|------------|--------------------------|
| Total patients | 32 (100) |
| Males | 29 (90.6) |
| Age | 14.3 ± 8.7 |
| Day of presentation to health facility after onset of illness | 3.7 ± 1.3 |
| Day of resolution of symptoms | 5.7 ± 1.6 |
| Ambulatory status | |
| Ambulatory | 25(78.1) |
| Nonambulatory | 7(21.9) |
| Reflexes | |
| 2+ | 25(78.1) |
| 1+ | 6(18.8) |
| Absent | 1 (3) |
| Hypokalemia | 4 (12.5) |
| Serology positivity | |
| Dengue | 4 (12.5) |
| Influenza | 9(28.1) |
| Nonspecific | 19 (59.4) |
| EMG findings | |
| Normal | 16(50) |
| Mixed (Normal +myopathic) | 12 (37.5) |
| Myopathic | 4(12.5) |
| Spontaneous activity | 15 (46.8) |
| Prodrome type | |
| Respiratory | 12 (37.5) |
| Diarrhoeal | 3 (9) |
| Nonspecific | 17 (53.1) |
| Symptoms | |
| Myalgia | 21 (65) |
| Cramps | 1 (3) |
| Fatigue | 2 (6) |
| Proximal weakness (Lower limbs> upper limbs) | 14 (43) |
| Quadripareisis | 1 (3) |
A significant number of patients had elevated muscle enzymes such as CPK, SGOT, SGPT, and LDH at the time of presentation. Median value of CPK on day 1 of presentation was 987 units/litre (range, 367–9170 units/litre), whereas those of SGOT and SGPT were 176 units/litre (range, 66–458 units/litre) and 112 units/litre (range, 43–354 units/litre), respectively. Serum bilirubin on day 1 was in the upper normal range (mean of 1.1 mg/dl), whereas serum creatinine values were also normal. Platelet counts were low on day 1 of hospital stay (mean of 1.14 lakh with range from 78,000 to 189,000/mm³). All the abnormalities in muscle enzymes and platelet counts showed an improving trend on serial monitoring during the hospital stay, which was significant [Table 2][Figures 3-5].

On clinical electrophysiological examination, amplitude and distal latencies of common peroneal, sural, and median nerves were in the normal range in all the patients. Electromyographic (EMG) studies on quadriceps muscle of the affected patients showed myopathic pattern in 16 (50%) cases. Others showed near-normal EMG with less than 20% polyphasia perhaps because of EMG being performed in the recovery phase of the illness.

The mean time required for resolution of symptoms in our cohort was 5.7 days with a range from 4 to 10 days [Figure 6]. The final diagnosis at the time of discharge was post-influenza myositis in 9 (28.1%) patients and post-dengue myositis in 4 (12.5%). In all other patients, serologies for these and other infections, such as scrub typhus, leptospira, and cytomegalovirus, came out to be negative. Nonspecific viral infections (59.4%) caused the major chunk of myositis in our study.

**Discussion**

Acute viral myositis, variably known more commonly as BACM is a well-described but rarely recognized entity in clinical practice. Only two studies from South India have highlighted this issue, whereas remaining studies are from western world and Middle East countries. Various peculiar features of this disease as described in this study need special mention so that emergency care practitioners could keep a differential diagnosis while evaluating cases of lower limb weakness, particularly in young children.

The median age group in our study was 12 years. The youngest child in our study was of 6 years, whereas the oldest case recorded was of 54 years. Most of the cases are males. None of the cases had recurrence. The disease is rare in adults but has been reported.[4-5] The cause for this childhood predominance and low incidence of recurrence has been reported in only few studies.[6,7] Dietzman et al.[6] and Ruff and Secrist[7] postulated that first occurrence of BACM reflected the initial exposure of influenza. If any recurrence was present, it was due to a different virus. Greater incidence in boys may be due to increased physical activity of boys or due to underreporting in girls. There may be a possibility that BACM may occur in genetically susceptible individuals with a metabolic defect provoked by a viral trigger.[8]

Most of the cases occurred in the month of July and August followed by January and February. This is in concurrence to an Indian study showing increased occurrence of GBS in the months from February to July.[9] This may be due to the fact that most common prodromal illnesses precipitating GBS, such as respiratory illness and diarrhea, could be same for viral myositis too.

Most of the patients presented acutely with mild weakness. The patients presented to the hospital after
mean illness duration of 3.7 days. Most of the patients were ambulatory (78.1%). Severe symptoms in the form of quadriparesis or proximal weakness hampering daily activities were present in 46% cases, whereas most of them had mild symptoms in the form of myalgia, cramps, and fatigue. In the cases of proximal weakness, lower limbs were more involved than upper limbs. This pattern of lower limb predominance with symptoms, such as myalgia or cramps in which gastrocnemius and soleus were more frequently involved than anterior thigh muscles, is also described in literature.\[8\] Deep tendon reflexes were normal in 78.1% cases, whereas reduced in 18.8%. Only one patient had quadriparesis with absent reflexes. Most of the patients in our study had resolution within 1 week of onset of symptoms. This typically highlights the benign nature of the illness.

Rhabdomyolysis leading to renal failure, facial, bulbar, and neck flexor weakness, generalized tonic-clonic seizures, respiratory paralysis requiring ventilator stay, shock, and death have been described in some studies but these studies may represent the fulminant group of viral infection complicated by secondary bacterial infection or an autoimmune phenomena triggered by viral infection.\[1,10,11\] So, it is pertinent to investigate

| Table 2: Laboratory parameters in time line with $p$ value using Friedman test |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                | Mean Rank Day 1 | Mean Rank Day 3 | Mean Rank Day 5 | Mean Rank Day 7 | $p$ value       |
|----------------|----------------|----------------|----------------|----------------|----------------|
| CPK            | 3.58           | 3.42           | 2.0            | 1.0            | <0.0005        |
| SGOT           | 2.53           | 2.47           | 1.0            | -              | <0.0005        |
| SGPT           | 2.31           | 2.34           | 1.34           | -              | <0.0005        |
| LDH            | 2.38           | 2.38           | 0.25           | -              | <0.0005        |
| Platelet count | 1.50           | 1.69           | 2.81           | -              | <0.0005        |

Figure 3: Line diagram showing rise of platelet counts after hospital admission

Figure 4: Line diagram showing fall of liver enzymes during the course of illness

Figure 5: Bar diagram showing the number of cases monthwise

Figure 6: Bar diagram showing the day of resolution of symptoms
Hypokalemia (potassium levels <3.5 meq/L) was present in four (12.5%) cases of our cohort. The lowest recorded potassium level was 2.9 meq/L. All the cases had proximal lower limb weakness in the form of difficulty in getting up from sitting position. They required potassium supplements for initial 2–3 days of hospital stay to maintain normal serum potassium levels. Although muscle inflammation and rhabdomyolysis are expected to cause hyperkalemia, the contrary may be due to increased aldosterone/cortisol secretion as a result of adrenal cortex inflammation or excessive leakage of potassium through leaky renal tubules in a systemic disease such as viral infection. The exact mechanism, however, needs further studies.

Nerve conduction studies of median, common peroneal nerve, and sural nerves were normal in all the patients. EMG studies revealed approximately 50% having myopathic pattern. This low EMG positivity could be due to performing the test in the late phase of illness in some of the cases. This can also be expected in a case of inflammatory myopathy as in the case of acute viral myositis because of the fact that it is a focal myositis and insertion of EMG needle in a normal area of muscle could give normal potentials as in our case. One study has shown resolution of EMG findings on follow-up data of mean 7.8 months. We did not consider repeat EMG in our patients as they were completely asymptomatic at follow-up of 6 months and 1 year.

Our patients recovered completely after a mean duration of 5.7 days after which they were discharged. None of the patients required more than supportive treatment in the form of paracetamol and fluids. All the muscle enzymes such as CPK, SGOT, SGPT, and LDH showed a steady and significant declining trend in alternate day values till the 5th day of hospital stay. The use of steroids in one study, resulting in rapid improvement of symptoms, has not been supported by any other studies till date. The authors in that study used it after a mean symptomatic period of 25.1 days, but this is not relevant in our cases as they spontaneously recovered within a week. We did not wait for complete resolution of muscle enzyme values, which has been shown to remain elevated for 4 months in another study.

Our cases had dengue serology positivity in 12.5% cases and H1N1 virus polymerase chain reaction (PCR) positivity in 59.4% cases. The rest of the cases were negative for investigated etiologies such as mycoplasma, cytomegalovirus, Epstein–Barr virus, leptospira, and scrub typhus. Acute rhabdomyolysis has been reported to be caused by other viral etiologies such as Coxsackie B5 virus, echovirus 9, adenovirus 21, picornavirus, myxovirus, and herpes simplex virus but in most of the cases, viral isolation has not been successful in histopathology or culture. Only Mackay et al. has reported viral isolation by culture and direct immunofluorescence in 42% episodes. Our negativity in the remaining 28.1% cases may be due to the fact that we have not tested for other viruses because of technical issues.

Other alternative diagnosis for post-viral myositis could be GBS, partial transverse myelitis, benign synovitis of hip joints, conversion reaction, acute cerebellar ataxia, juvenile rheumatoid arthritis, malignancy, and parasitic myositis such as trichinosis. These diseases behave differently and most of them require specialist opinion for their management. On the basis of salient findings of post-viral myositis as in our cohort, we propose a diagnostic criteria for this disease consisting of both clinical and laboratory findings.

Clinical criteria:
1. Onset in the first two decades of life
2. Viral prodrome, 3–4 days before the onset of symptoms
3. Weakness in proximal muscles with lower limb predominance
4. Cramps/myalgia alone or accompanying weakness
5. Normal to decreased deep tendon reflexes
6. Resolution within 2 weeks after the onset of symptoms

Laboratory criteria:
1. Raised muscle enzymes such as CPK, SGOT, and SGPT
2. Low or normal potassium levels
3. Myopathic or normal electromyography
4. Normal nerve conduction studies
5. Positive viral serology/PCR from nasal or throat swab

The more criteria a patient fulfills, the greater chance that he or she has this disease. We conclude that BACM is a diagnosis, which reassures a better prognosis in a clinical situation where the other differentials have a relatively poor prognosis. It should always be kept in mind while dealing with patients of acute neuromuscular pain and weakness to subvert more aggressive management while keeping patient under observation.
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Conflicts of interest
There are no conflicts of interest.

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