Case Study

Intensive physiotherapy with subsequent community-based rehabilitation: two cases of cerebral malaria in rural areas of Malawi

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Abstract. [Purpose] This study aimed to elucidate the effect of intensive physiotherapy and community-based rehabilitation on motor function for patients with cerebral malaria in the rural areas of Malawi. [Participants and Methods] The participants were 10- and 9-year-old children with cerebral malaria. At ages 8 and 6 years, they contracted malaria, and their motor function decreased to Gross Motor Function Classification System level III. They underwent intensive physiotherapy for 2 weeks administered by their mothers and volunteers, who were taught rehabilitation exercises. The improvements in the participants’ motor functions were assessed after completion of therapy and 2 months later. [Results] In case 1, no improvement was observed in the 88-item Gross Motor Function Measure (GMFM-88) score after intensive physiotherapy. However, after 2 months of intensive physiotherapy, the total score improved by 6% from 61% to 67%, and the scores for the target areas improved from 12% to 20%. In case 2, the total GMFM-88 score improved from 66% to 68% during physiotherapy and further improved from 68% to 78% after 2 months. The score for the target areas improved from 25% to 26% and further improved from 26% to 49% after 2 months. [Conclusion] The participants in this study achieved improvements in GMFM-88 score after receiving intensive rehabilitation by community members. The effect was more pronounced after 2 months than immediately after intensive physiotherapy.

Key words: Cerebral malaria, Intensive physiotherapy, Community based rehabilitation

INTRODUCTION

In tropical countries, falciparum malaria is a leading cause of neurodisability and death. Despite 40% of the world being at risk of suffering malaria, a majority of cases are in sub-Saharan Africa. Young children, especially those under 5 years old are most at risk, but the number of infections decreases as the children age and their immune systems develop1).

Approximately 575,000 children in Africa develop cerebral malaria each year, and it is most common at pre-school age, yet cases of severe malaria are reportedly decreasing3).

Forty four children who had been diagnosed with cerebral malaria were researched in Uganda, and it was reported that 28.2% still had neurological manifestations on discharge, but this decreased to 9.5% after 3 months and 0% after 6 months3). Especially blindness, ataxia and low muscle tone of the proximal muscles improved over time4–6). However, it was reported that epilepsy and abnormal behavior, as well as some other neurological features occurred after discharge7). Regarding motor deficits, central hypotonia improves approximately 3 months after onset of cerebral malaria, but monoparesis, hemiplegia and spastic quadriplegia are permanent prognostic symptoms8). In 2010, Idro reported improvement by physiotherapy in the case

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of 6 children at GMFCS grades III–IV with severe movement and gait disorders (ataxia, dystonia)\(^9\). However, there are few studies besides this that deal with physiotherapy for cerebral malaria.

As per the 2008 population and housing census, the population of Malawi was about 1,300,000\(^10\), and of those, about 4% had a physical disability, with 108,860 having problems walking\(^11\).

A physiotherapist’s goal, when a person suffers from disability caused by disease or injury, is to improve their quality of life by restoring movement and function\(^12\). As musculoskeletal, orthopedic and neurological disabilities continue to occur at a constant rate, there is obvious need for physiotherapy services in Malawi. In fact, it is common for district hospitals to have no therapy services at all. In Malawi this lack of physiotherapist is concerning; there were only 34 in 2011, which equates to 1 physiotherapist per every 483,870 individuals\(^13\). Furthermore, only 23.8% of people with disability that expressed a need for rehabilitation were able to be treated\(^14\). Therefore, in rural areas, it is important to receive rehabilitation from family or community members because of this shortage of physiotherapists. Even so, the net enrollment rate for elementary education in Malawi is especially low, and was 81.0% in the area that this study occurred. The net enrollment rate above 15 years old is 65.4% for the whole of Malawi, and the elementary education enrollment rate of women involved in childcare in this area was 56.8%\(^15\). One issue is that a lack of understanding regarding educational guidance and care from families is not provided, and the low educational level in Malawi is not well understood.

The sponsoring NGO (Sue Ryder Foundation in Malawi) provided Community Based Rehabilitation (CBR)\(^16\) and volunteers at each clinic helped with the rehabilitation, finding new clients in their village, and supporting them.

In Japan, intensive physiotherapy is suggested for increasing GMFM-88 score rather than normal treatment in the rehabilitation guideline for cerebral palsy\(^17\). One meta-analysis, which targeted four RCTs regarding intensive physiotherapy for cerebral palsy, reported that physiotherapy four or five times per week increased the GMFM-88 score more than normal treatment\(^18\). However, those reports were from developed countries. There is a lack of guidelines for the assessment and management of cerebral palsy in Africa, although it is reported that there will be research regarding the rate of disease and risk factors\(^19\). There is little research regarding cerebral malaria, and in particular there are no reports of patients staying in rural areas of developing countries who have difficulty receiving proper rehabilitation. Herein, we report on treatment to find effective approaches for children with cerebral malaria.

**PARTICIPANTS AND METHODS**

Case 1 was a 10-year-old child, who contracted malaria at 8 years old. Before contracting malaria, she was independent for ADL and was going to school. After the onset of malaria, motor function decreased to GMFCS level III, and there were cognitive function problems, speech problems and epilepsy. Additionally, help in ADL without feeding was required. In 2015 August, outreach rehabilitation and family guidance began, and happened once a month.

She was able to understand language, but speech was slow and only a few words were used for conversation. Although intention was clear, there was difficulty with requesting. She was able to move around by crawling, but movement was slow and carrying by her mother was required outside the house.

GMFM-88 was used to check motor function. The rates were lying and rolling 100%, sitting 96%, crawling and kneeling 87%, standing 13% and walking, running and jumping 11%. The total score was 61%, thus it was decided that the goal areas would be the standing and walking tasks, so the total goal area score was at 13%.

Forty minutes’ treatment was provided each morning and evening, 5 times per week. Treatment was centered on the mother, and that treatment was planned by the physiotherapist to improve the standing and walking tasks on the GMFM-88.

Case 2 was a 9-year-old child, who contracted malaria at 6 years old. Before contracting malaria, he was independent for ADL and was going to school. After onset of malaria, his motor function decreased to GMFCS level III. He was independent for ADL without bathing, but required help to move outside the house. In 2015 August, we started outreach rehabilitation and family guidance once a month.

There was a decline in gross motor function, but no other disorders. His personality was brimming with curiosity, and he attended primary school.

GMFM-88 was used to check motor function. The rates were lying and rolling 100%, sitting 100%, crawling and kneeling 80%, standing 30% and walking, running and jumping 19%. The total score was 66%, thus it was decided that the goal areas would be the standing and walking tasks, so the total goal area score was at 25%.

Forty minutes’ treatment was provided each morning and evening, 5 times per week. Treatment was centered on the mother, and that treatment was planned by the physiotherapist to improve the standing and walking tasks on the GMFM-88.

This study was conducted using methods according to and described by the Japanese Physical Therapy Association. All patients consented to the treatment provided.

**RESULTS**

In case 1, GMFM-88 was used to check her motor function. There was no improvement before and after intensive physiotherapy. However, after 2 months of intensive physiotherapy, a slight improvement was observed. Sitting task had improved from 96% to 98%, crawling and kneeling tasks had improved from 87% to 97% and standing task had improved from 13%
to 28%. Meanwhile in the walking, running and jumping tasks there was no change. The total score had improved 6% from 61% to 67%, and the total goal areas had improved from 12% to 20% (Table 1).

In case 2, GMFM-88 was used to check motor function. Crawling and kneeling task improved from 80% to 87% during the intensive physiotherapy, and improved by an additional 6% from 87% to 93% after 2 months. Standing task improved from 30% to 33%, and improved by an additional 41% from 33% to 74% after 2 months. In the walking, running and jumping tasks, there was no improvement from 19% during intensive physiotherapy, but after 2 months it had improved from 19% to 24%. The total score had improved from 66% to 68% during intensive physiotherapy, and after 2 months it had further improved from 68% to 78%. The total goal score had improved from 25% to 26%, and after 2 months the improvement was from 26% to 49% (Table 1).

**DISCUSSION**

Cerebral malaria patients were brought from a rural area to the rehabilitation center, and were provided 2 weeks of intensive physiotherapy and educational guidance. Case 1 didn’t show any improvement and case 2 improved slightly during the intensive physiotherapy, but after 2 months the improvement was greater. However, in the walking task there was only a slight improvement.

In Japan, intensive physiotherapy is suggested to increase the GMFM-88 score rather than standard treatment in the rehabilitation guideline for cerebral palsy\(^{17}\). In one meta-analysis, which targeted four RCTs regarding intensive physiotherapy for cerebral palsy, it was reported that physiotherapy 4 or 5 times per week increased the GMFM-88 score more than standard treatment\(^{18}\).

Asagai et al. reported that intensive physiotherapy for children affected by cerebral palsy with GMFCS level III showed improvement in GMFM-88 standing and walking tasks\(^{20}\). Another report also indicated that 2 weeks of intensive physical therapy showed effects\(^{21}\). Dambi JM et al. compared the effects of outpatient rehabilitation at the hospital and outreach rehabilitation in the community. The report showed that children receiving outreach rehabilitation are older and have improved motor function, while the satisfaction of caregivers was higher than in outpatient rehabilitation\(^{22}\).

This report also shows that 2 weeks of intensive physiotherapy improved GMFM-88 in both cases; in particular the standing task improved greatly after 2 months (case 1: 15% and case 2: 44%). It is considered that continued appropriate treatment, after completion of the intensive physiotherapy, from the mother and community volunteers is central to this treatment. This study shows the possibility that intensive physiotherapy and following community based rehabilitation has an effect on the improvement of motor function for children with cerebral malaria in rural areas of Africa. The program was prepared and carried out in the same way as physiotherapy for cerebral palsy. Thus, the same physiotherapy as used in cerebral palsy shows improvement in gross motor function for children with cerebral malaria. In cases where rehabilitation is not performed, the WHO describes monoparesis, hemiplegia and spastic quadriplegia as being permanent prognostic symptoms\(^{8}\). In these 2 cases, the participants had suffered from Malaria from 2 to 3 years and had received outreach rehabilitation, but had not shown improvement prior to this intensive physiotherapy. Thus, we consider that the described improvement was achieved through intensive physiotherapy and the following community based rehabilitation.

In the GMFM-88 walking task there was only slight improvement. This may be related to the environment in the rural areas of Malawi. Roads are rough and unpaved, and movement outside of the house is over long distances. Therefore, as the children are always carried by the mother to move around, there is less experience of walking and thus the walking function had not improved.

Cerebral malaria patients were recruited from rural areas of Malawi and provided 2 weeks of intensive physiotherapy and educational guidance to their families and volunteers. As improvement was observed in the GMFM-88, it is considered that intensive physiotherapy and the following community based rehabilitation had an effect on improving motor function for children with cerebral malaria in rural areas of Malawi.

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**Table 1. GMFM-88 pre, post, and 2months post treatment**

|                  | Case 1 | Case 2 | Case 1 | Case 2 |
|------------------|--------|--------|--------|--------|
|                  | Pre treatment | Post treatment | 2 months post treatment | Pre treatment | Post treatment | 2 months post treatment |
| Lying & rolling  | 100    | 100    | 100    | 100    | 100    | 100 |
| Sitting           | 96     | 96     | 98     | 100    | 100    | 100 |
| Crawling & kneeling | 87     | 87     | 97     | 80     | 87     | 93 |
| Standing          | 13     | 13     | 28     | 30     | 33     | 74 |
| Walking, running & jumping | 11     | 11     | 11     | 19     | 19     | 24 |
| Total score      | 61     | 61     | 67     | 66     | 68     | 78 |
| Goal total score | 12     | 12     | 20     | 25     | 26     | 49 |
Conflict of interest

There were no apparent conflicts of interest in this case study.

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