

Conference Paper

Feeding Difficulties in Children with Cerebral Palsy: Prevalence and Risk Factor

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Abstract

Cerebral palsy (CP) is a motor and postural disorder due to an injury on the developing brain. Children with severe motor impairment are likely to have more difficulties in feeding. This results in inadequate calorie intake which finally leads to malnutrition. A cross-sectional study was done between January-September 2015 in a pediatric neurology outpatient-clinic, at a tertiary hospital in Surakarta, Indonesia. Children with CP underwent the Gross Motor Function Classification System (GMFCS) scale, nutritional and feeding difficulties assessment. The GMFCS was evaluated by Gross Motor Function Measure-88. Nutritional status was determined and classified based on Waterlow. Spastic quadriplegic patients were also compared to Krick's CP growth curve. Calorie intake was evaluated by dietary analysis and defined as adequate if it reached $13,9 \text{ kcal/cm body height (BH)} \pm 10\%$. Most of the CP patients were the spastic type (77/80,96%), dominated by quadriplegic and diplegic types. Malnutrition was found in 78% of subjects. Feeding difficulties were found in 78% of subjects, about a third of them was categorized as having high GMFCS scale. The prevalence of undernourished and severe malnutrition in children with CP is 68% and 10%, respectively. The higher GMFCS scale and CP with spastic type are risk factors of feeding difficulties in children with CP.

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1. Introduction

Cerebral palsy (CP) is a disorder of motor function and posture due to brain development injury [1-3]. Malnutrition in children with CP is related to feeding difficulties that will result in an increase of morbidity and mortality in children with CP. The prevalence of feeding difficulties in children with CP varies from 30 to 90% [4]. Some other disorders such as intellectual disability, visual and hearing impairments, and seizures also affect the degree of difficulty in feeding in children with CP [5].

Children with CP, particularly spastic type of CP, need more energy and more calories than normal children. They usually have less food intake which can be caused by short meal times, less optimal eating position, severe oromotor abnormalities and low-calorie

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density foods provided by their parents [6]. They often have severe physical abnormalities including postural, tone, and movement abnormalities that can result in abnormal motor development affecting the eating process [4, 6]. Feeding difficulties often cause severe emotional stress to parents or caregivers who are responsible for feeding, meal times can become tense and unpleasant [4].

There are several instruments to assess the severity of impaired motor function of CP in a qualitative way, including the Gross Motor Function Classification System (GMFCS). The GMFCS has been validated and used throughout the world to assess motor function in all ages. This instrument assesses 5 levels of gross motor function among different age level (<2 years, 2-4 years, 4-6 years, 6-12 years, and 12-18 years) [7-9]. The GMFCS also has a significant correlation with the International Classification of Impairments, Disabilities, and Handicap (ICIDH) [10].

It has been studied that GMFCS IV-V had a significant relationship with the incidence of nutritional disorders in quadriplegic spastic CP, but was not significantly associated with hearing loss or visual impairment [11]. It has been reported that the GMFCS scale had a significant relationship with visual impairment, hearing loss, nutritional disorders and incidence of epilepsy [12]. Another study found a significant relationship between type, CP topography and GMFCS scale [13]. This present study defined nutritional disorders based on anthropometric nutritional status and aimed to find out feeding difficulties in children with CP based on the GMFCS scale and also the anthropometric status.

2. Methods

This was a cross-sectional study in children with cerebral palsy who presented to the pediatric neurology outpatient clinic in Dr. Moewardi Hospital, Surakarta, Indonesia, from January 1st to September 30th, 2015. Children with CP were examined based on the GMFCS scale, nutritional status, and feeding difficulties. The GMFCS scale was measured using a measurement instrument of Gross Motor Function Measure-88 (GMFM-88). The anthropometric nutritional status was measured using the Centers for Disease Control and Prevention-National Center for Health Statistics (CDC-NCHS) 2000 curve. The patients with CP quadriplegic spastic type were anthropometrically measured using the Krick's CP growth curve. The nutritional status was determined based on Waterlow classification criteria. The calorie intake was measured by analysis of diet recall for 3 days and considered sufficient if met 13.9 kcal/cm body height (BH) \pm 10%. The feeding difficulties were assessed by history, physical examination, and eating ability observation. Data were analyzed and tested statistically using SPSS 22.0. The analysis was

performed using the Chi-square test, to also determined the odds ratio (OR) with a 95% confidence interval (95% CI).

3. Results

Eighty children, 44 boys, and 36 girls, with a diagnosis of CP, were included in this study, aged from 13 months to 9 years old. About 96% of subjects had spastic CP type with quadriplegic and spastic diplegic type. Table I shows that about 67.5% of the subjects were undernourished. The basic characteristics of the subject can be seen in Table 1.

TABLE 1: Baseline characteristic.

Characteristic	n (%)
CP type	
Spastic quadriplegic	33 (41,2)
Spastic diplegic	32 (40)
Spastic hemiplegic	9 (11,2)
Spastic paraplegic	3 (3,8)
Hypotonic	3 (3,8)
GMFCS scale	
I	16 (20)
II	11 (13,8)
III	20 (25)
IV	6 (7,5)
V	27 (33,7)
Nutritional status	
Malnutrition	8(10)
Undernourished	54(67,5)
Well-nourished	18(26)

Most of the subjects were identified as the quadriplegic spastic type of CP with GMFCS scale level V. The GMFCS scale type I was the most common in spastic hemiplegic. Two-thirds of subjects (54/80, 67,5%) experience malnutrition. Eight out of 80 subjects experienced malnutrition and most of them were children with CP with GMFCS scale level V. There were no subjects with obesity. The spastic quadriplegic type subjects were then recalculated using the Krick curve, only 10 out of 33 spastic quadriplegic subjects experienced undernutrition and none suffered from malnutrition. Almost all of the subjects who with undernutrition were lack of calorie intake and severe levels of GMFCS.

Our study found 62 subjects (78%) suffered from feeding difficulties. Thirty percent of them were children with CP in GMFCS scale level V. The most common complaints of

TABLE 2: Calorie intake and feeding difficulties in children with cerebral palsy based on the GMFCS scale.

	Calorie intake		n	Feeding difficulties	
	Inadequate	Adequate		OMD ^a	BPC ^b
GMFCS scale					
I	10	6	16	6	1
II	6	5	11	1	5
III	17	3	20	15	13
IV	5	1	6	2	2
V	24	3	27	21	19
^a OMD = oromotor dysfunction					
^b BPC = bad postural control					

feeding difficulties were swallowing difficulty (42%), longer time of feeding (33%), choking/coughing (15%), difficulty in drinking (28%), and vomiting (18%). Oromotor dysfunction (OMD) was the most frequent etiological factor for feeding difficulties in children with CP (56%). Another common causative factor was bad postural control (BPC). Almost all of the subjects with malnutrition and undernutrition had OMD and BPC.

The results of the statistical analysis of the GMFCS scale on OMD and the GMFCS scale on BPC showed significant results: a p-value of 0.042 ($p < 0.05$) and a p-value of 0.041 ($p < 0.05$) respectively. The results of the incidence of feeding difficulties in children with CP in each risk factor showed that there was an association between GMFCS scale and OMD (OR 9.86; CI 95% 2.64-34.57), type of CP risk factor against OMD (OR 8.56; CI 95% 2.25-28.33). GMFCS scale is also associated with BPC (OR 6.35; CI 95% 3.29-24.12), type of CP risk factors against BPC (OR 4.32; CI 95% 2.53-22.35).

4. Discussion

Most of the subjects were spastic type CP (96%) with quadriplegic and diplegic type. The results are not much differed from the previous study [12]. An enormous number in that study can be caused by the lack of good health care and a lack of optimal therapy. It makes sense that CP patients who come to Dr. Moewardi hospital often presented with severe conditions as our hospital is one of the referral hospitals.

Most of the subjects were children with CP who had a GMFCS scale level V of 34% of the total subjects, this result is consistent with previous research [14]. A study in the United States got contrary results, they expressed GMFCS II at the most [15]. This discrepancy may be caused by underdeveloping of early detection, diagnostic and therapeutic procedures in the developing country. The prevalence of malnutrition in children with CP in developing countries is higher when compared to developed countries [16-18].

This study shows that there is a correlation between the type of CP and the scale of GMFCS. This is due to the key assessment of the GMFCS scale is gross motor functional development, especially the ability to move or mobile without the help of others. The scale of GMFCS level I is mostly found in spastic hemiplegic type, this is consistent with other research [12, 19, 20].

The highest amount of GMFCS level V was obtained on quadriplegic spastic CP. Quadriplegic spastic CP patients have poor ability to move or mobile without the help of others, and the GMFCS levels are high. This result is also in accordance with other research, quadriplegic-type CP patients who have GMFCS level V will have higher comorbidity compared to other types and lower level [12, 19, 20].

We also found that some subjects who get adequate calorie intake still have malnutrition. This needs to be further evaluated to find other factors that affect the occurrence of malnutrition such as gastroesophageal reflux (GER) or chronic diseases which were not observed in this study. Some other disorders such as intellectual disability, visual and hearing impairments, and seizures also affect the degree of nutritional status in children with CP [5].

Malnutrition in children with CP is strongly associated with a lack of calorie intake. Even though the energy needed by CP patients was less than that of normal children but the calorie intake also less [16, 24]. This study showed that approximately 78% of subjects had less calorie intake.

Children with CP are at risk of experiencing a shortage of oral intake for a number of reasons including as a result of oromotor dysfunction, pharyngeal phase disorders associated with aspiration and communication difficulties that reduce the ability to request food and drink. Children with CP often have severe physical abnormalities including postural, tone and movements abnormalities that can result in abnormal motor development that affects the eating process [5, 6]. Feeding difficulties often cause severe stress on parents or caregivers who are responsible for feeding, eating time becomes tense and unpleasant [5]. This study shows that almost all subjects with poor calorie intake also have trouble eating. Evaluation of the schedule of eating routines and the interaction between caregivers and children is a very important component to ensure the adequacy of nutritional intake and children's ability to eat [21].

Malnutrition in children with CP is associated with feeding difficulties, hence feeding difficulties will increase morbidity and mortality in children with CP [4]. There is no consensus on the definition of feeding difficulties in children with CP. This study uses the definition proposed by Palmer *et al* [5], namely the inability to receive certain

foods caused by neuromotor abnormalities, obstructive lesions, or psychological factors related to the eating process.

Children with CP are at risk of experiencing a deficiency of oral intake for a number of reasons including as a result of oromotor dysfunction, as pharyngeal phase disorders are associated with aspiration and communication difficulties that reduce the ability to request food and drink [14]. There are several risk factors or clinical clues that indicate feeding difficulties. The most common complaints about feeding difficulties in this study were swallowing difficulties (42%), longer time of feeding (33%), choking / coughing (15%), difficulty in drinking (28%), and vomiting (18%) which are consistent with previous research [22].

This study showed that 78% of subjects had feeding difficulties, this result was greater than the number obtained in the United States. The difference is due to differences in the methods used, Fung et al used questionnaires while this study used observation assessments. This study also did not use supporting examinations such as video recorders [4]. Feeding difficulties can occur in all types of cerebral palsy, but the most at risk are quadriplegic spastic children, while spastic diplegic and hemiplegic tend to have less significant feeding difficulties [21]. Children with high spastic tend to show eating problems with certain textures, while children with quadriplegic spastic usually experience some degree of difficulty with all textures. This is due to wider lesions, not only in motoric extremities but also lesions in visual-motor coordination, sensory-motor, and posture [21, 22].

In this study, OMD is the most common cause of eating difficulties, this is consistent with other research [6, 8]. The weakness of sucking, drooling, poor lips seal are the types of OMD found in the subject of this study, this is also consistent with previous research [23, 24]. The most contributing factor to oromotor control disorders is a motor problem [21]. In children with CP, the type of CP and the degree of impaired motor function correlates with oromotor dysfunction. This study shows that oromotor dysfunction is most commonly found in children with severe GMFCS scale, as it has been reported in other research [16, 22, 25, 26].

Posture control disorders are also the biggest cause after OMD in feeding difficulties in the subject of this study. Children with motor disorders such as in CP show high, low or fluctuating postural tone and muscle tone. The pattern of movement of the children is sometimes automatically due to reflexes or reflex movements that synergistically occur in deliberate movements. Most children have difficulty in coordinating and timing their movements; for example, there is an uncoordinated mouth and body movement during

feeding, also affecting the movement and timing of sucking, swallowing and breathing [16, 21].

This study shows a significant relationship between the scale of GMFCS and OMD. There was a high incidence of malnutrition in quadriplegic spastic type CP patients. The GMFCS level IV-V scale had a significant relationship with the incidence of nutritional disorders at quadriplegic spastic PS [11, 26]. The oromotor dysfunction (OMD) is closely related to the low GMFCS scale. Significant results were also shown on the statistical analysis test of GMFCS scale relation to BPC. Good posture control is needed to support the success of the eating process. Children with CP tend to have poor posture control, especially in quadriplegic spastic CP and severe GMFCS levels [5, 27].

The ability to eat is strongly associated with the scale of GMFCS [25]. The prevalence of eating difficulties in children with CP was strongly associated with the neurological abnormalities and scale of GMFCS [16]. The severity of the GMFCS scale will increase the number of gastrointestinal problems and the difficulty of eating will be more frequent [22].

Children with CP are at risk of experiencing a shortage of oral intake for a number of reasons including as a result of oromotor dysfunction, as pharyngeal phase disorders are associated with aspiration and communication difficulties that reduce the ability to request food and drink [21]. Children with CP often have severe physical abnormalities including abnormalities in posture, tone, and movements that can result in abnormal motor development that affects the feeding process [5, 6]. Abnormalities of the neck and trunk posture will cause difficulty in swallowing, while postural abnormalities of the pelvis and extremities cause difficulty in mobilization [6].

This is the first study to describe the relationship between the GMFCS scale and the feeding difficulties in children with CP in Indonesia. The limitation includes only a few types of CP (spastic and hypotonic) in our hospital. The result shows that the GMFCS scale is a risk factor for feeding difficulties for children with CP. Heavier GMFCS scale would be a greater risk of eating difficulties in children with CP. We believe that by detecting feeding difficulties in children with CP based on GMFCS scale, malnutrition in children with CP related to morbidity and mortality can be prevented.

5. Conclusion

The prevalence of undernourished and severe malnutrition in children with CP is 68% and 10%, respectively. The causes of feeding difficulties in children with CP are oromotor dysfunction and bad posture control. There is a relationship between the GMFCS scale

and feeding difficulties in children as indicated by the most common causes (oromotor dysfunction and bad posture control). The heavier the GMFCS scale, the oromotor dysfunction and posture control become worse. The GMFCS scale and type of spastic CP are risk factors for feeding difficulties in children.

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