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Nutritional Status and Nutritional Support in Children with Congenital Malformations of Brain in Ukraine: Single-Center Observational Descriptive Cross-Sectional Study

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Abstract: Causes of protein-energy malnutrition (PEM) in them are multifactorial, and malnourishment may be due to motor disorders, digestive problems, medicine use, and the social environment.

PEM is one of the most serious medical problems around the world. According to WHO research, in poor families in 22-35% of children aged 2 to 6 years, the body weight (BW) is below the 5th percentile, the growth of 11% of children is below the 5th percentile. In hospitalized children, various forms of PEM are still common, which aggravates the course of the disease, worsens their prognosis, and causes a delay in the physical and neurological development of children.

In Ukraine, as one of low income and middle income countries (LMICs), PEM is detected and diagnosed not quite actively especially in children with neurologic impairment.

Objective: Assessment of nutritional status and nutritional support in children with congenital malformations of brain.

Goal. Assessment of nutritional status and nutritional support in children with congenital malformations of brain.

Methods and methods. The anthropometric assessment of the children, evaluation of oromotor dysfunction (OMD), a 24-hr dietary recall, assessment of nutritional status before ("baseline") and after 6 months of implementing of food modification ("endline") were studied. 17 children were recruited for the study (young children and pre-schoolers) who took part in the department of Palliative Care due to congenital malformations of brain. There were 9 (53%) young children (0-36 months) and 8 (47%) pre-schoolers (3-6 years). The average age was 3.6±2.1 years. All caregivers were female.

For nutritional status investigation the anthropometric assessment was used. Anthropometry was measured in accordance with the standard procedure. BW was measured using a digital weighing Infant Scale and was recorded to the nearest decimal place (0.1 kg). The H/L was estimated by means of Infant Length Board marked in cm and recorded nearest 0.1 cm. For children with paralytic syndromes the H/L was determined by measuring the length of the big tibia (cm) and calculated by formula due to inability to stand, scoliosis or joint contractures of patients.

Additionally the nutritional status included a study of a 24-hr dietary recall and questionnaire of caregivers. The following questions were included: *1. Does the child usually eat alone or with others? 2. When does the child eat? (Are the meals regular, how many times per day?) 3. Is there sufficient time for feeding? (Does the meal last more or less than 30 minutes?) 4. Do you apply special feeding (If no, what food do you choose?).*

Results. The sample included 9 males and 8 females. There were 14/17 children with paralytic syndromes (I-V level of GMFCS). Severe cognitive impairment was established in 8/17. Prevalence of OMD was in total sample, and was distributed as "mild" in 2/17 children, "moderate" in 4/17 and "severe" in 11/17 children. Severe OMD is associated with microcephaly, cognitive impairment and V level of GMFCS.

The feeding time was different in 5 tube-fed children compared with 12 bottle-fed or spoon-fed 12 children (median 11 min vs 32 min). There were no significant differences in correlation of OMD severity, sex or age.

The results of caregivers' answers for questionnaire demonstrated that all children had meals alone without any social component, regularly, minimum 4 times, maximum 6 times per day. None of them applied any special feeding formula. The meals length in 4 tube fed children was even less than 15 min. The 24-hr dietary recall demonstrated that only 3 children (younger than 1 year) received formula for feeding, others -"adult" meal (porridges, vegetables, milk and meat, pureed by texture modifications for consistency). All children were unable to feed themselves and needed some feeding assistance.

The moderate PEM was diagnosed in 2/17 children, severe PEM in 12/17 from the total cohort in "baseline" study. The distribution of PEM degree in "endline" was following: moderate PEM was found in 5/17 children, severe PEM in 9/17.

Our data was collected to compare the children with NS and without NS. The children with NS had much severe deviation of Z-score BW for age at "baseline" (median -6.2 vs -2.1) (MW test p=0.0111). We did not find any significant difference in Z-score deviation of H/L for age (median -2.7 vs -34) (MW test p=0.7429). The median of Z-score BW for age in total cohort was -3.2 [minimum -0.5 maximum -10.4], of H/L for age was -2.7 [minimum -0.5 maximum -7.1]. Among children who did not receive NS 2/8 children with loss of BW and 1/8 children with loss of H/L. In children who received NS 1/9 children with loss of BW and 4/9 children with loss of H/L. This suggests that a 6-month period with NS for PEM is not enough and requires further monitoring.

We found a significant difference in changes of Z-score BW for age in children under NS during 6 mo "baseline" and "endline" (median -6.2 vs -5.4) (W test p=0.0208) and no significant difference in changes of Z-score H/L for age in children under NS during 6 mo "baseline" and "endline" (median -3.4 vs -3.4) (W test p=1.0).

To correct PEM in children with congenital malformations of brain, speech therapists and physical therapists were involved as members of the multidisciplinary team. We proposed a training staff for monitoring the nutritional status in children with PEM and involvement of caregivers.

Conclusion. The study demonstrated moderate and severe nutritional disorders in young children and pre-schoolers with congenital malformations of brain: Z-score BW for age in total cohort was -3.2, H/L for age was -2.7 in LMICs. Its results differ from the previous studies that include children with CP. Late appointment of nutritional support to such children has been demonstrated, as well as its effect on increasing growth and body weight. High-quality clinical trials are needed to better comprehend the methodology of nutritive support in children with different neurological impairments.