Recommendations for Nutritional Management of Children with Neurological Impairment (NI)

ESPGHAN

NI relates to disorders of the central nervous system, affecting: speech, motor skills, vision, memory, muscle actions, learning abilities. Cerebral palsy is also considered within this guide as a major subgroup of NI.

NI frequently causes GI problems in children, most notably those with oral motor function and motility conditions (in children with cerebral palsy, for example, as many as 92% suffer from serious GI symptoms[1]) and can be extremely complex to manage. Such conditions can lead to insufficient caloric intake, a broad spectrum of GI and nutritional complications and associated clinical conditions, including respiratory infections and chronic aspiration, as well as a significant impact on quality of life for the patient and carer.

PATIENT MANAGEMENT GOALS

- Regular nutritional assessment
- Optimise oral intake but where this is not possible prompt nutritional intervention with non-oral methods
- Multidisciplinary approach and follow-up
- Parents and/or care givers to be involved in decision making – particularly concerning gastrostomy feeding
- Primary focus on improving quality of life for both the child and their family
- Professional ethicist to assist decision making concerning invasive procedures which pose ethical dilemmas

UNDERNUTRITION WARNING SIGNS

In the absence of strict criteria to identify undernutrition, ESPGHAN recommend 1 or more of the following warning signs to aid identification:

- Physical signs of undernutrition, e.g decubitus ulcers, skin problems and poor peripheral circulation
- Weight for age z score <-2
- Triceps skinfold thickness <10th centile for age and sex
- Mid-upper arm fat or muscle area <10th centile
- Faltering weight and/or failure to thrive

This guide, produced by the European Society of Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN), provides recommendations and a systematic approach for the care of paediatric patients with NI and should be read in conjunction with ESPGHAN Clinical Advice Guides on:

Dietetic Management of Children with Neurological Impairments

Common Gastrointestinal Issues for Children with Neurological Impairments: Evaluation, Treatment and Monitoring

Assessing Nutritional Status and Requirements

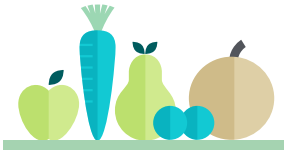
Laboratory assessments can be performed to identify undernutrition, although there is no single marker representing good or poor nutritional status in children with NI. These children often have lower mineral intakes than healthy children, predisposing them to having poor micronutrient status. Typically, deficiencies for iron, zinc, copper, vitamin D, carnitine, folic acid and vitamin B12 are common and lower values of serum albumin, prealbumin and retinol binding protein can be found.

Tube feeding and the use of nutrition supplements, however, were associated with higher concentrations of micronutrients in blood and serum.

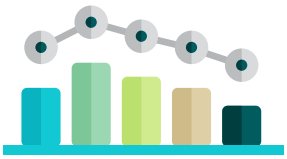
Identification of children with NI as being undernourished should therefore be based on the interpretation of anthropometric data as well as on the assessment of their micronutrient status.

ANTHROPOMETRIC MEASUREMENT	METHOD	NI CHALLENGE	ESPGHAN RECOMMENDATION
Weight	Wheelchair scales Sitting scales Hoist scales	Weight for height (WFH) is a poor indicator of fat stores in children with cerebral palsy. Low body mass index can also imply a low muscle mass but high fat mass	Assessment of nutritional status in children with NI should not be based solely on weight and height measurements
Height	Stadiometers – for those who can stand Supine length – good alternative for children able to lie straight Segmental length, such as knee-heel, tibia and ulnar using sliding calipers – reliable for monitoring growth for those unable to stand or lie straight	Many children with NI are not able to stand and have joint contractions, spasticity and/or scoliosis	Measurements of knee height or tibial length in children with NI should be performed routinely to assess linear growth, when height cannot be measured
Skinfolds and limb circumferences	Body fat estimated by using skinfold measurement usually at biceps and triceps region using a caliper	Interpretation challenging as children with NI tend to store fat around their abdomen rather than in skinfolds	Measurement of fat mass by skinfold thickness should be a routine component of the nutritional assessment in children with NI
Body composition	Whole-body dual-energy x-ray absorptiometry (DXA) is the best way to assess a child's fat stores	Nutritional status of children with NI more accurate using measures of body composition, including fat, water, protein and bone	Whole-body dual-energy x-ray absorptiometry (DXA) is the 'criterion standard' for body composition measurement
Bone status	Bone mineral density (BMD) assessment by DXA is limited to lumbar spine and hip	Due to hip flexion contractures, in children with severe NI, only lumbar DXA measurements are mostly performed	DXA scans should be used to measure bone mineral density

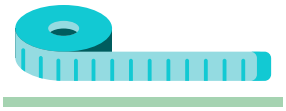
Monitoring Undernutrition



Micronutrients should be checked annually



Growth should be assessed in infants every 1 to 3 months



Follow-up anthropometry to be carried out at least every 6 months

Regular monitoring of body weight and fat mass recommended to assess energy requirements

Growth Charts

Standard or cerebral palsy specific growth charts are not reliable as growth patterns vary significantly from the general paediatric population.

ESPGHAN recommends:

WHO charts
For children whom reliable height can be calculated up to 5 years old and a relevant national growth chart for older children.

Alternative growth measurements for children with cerebral palsy
Segmental lengths including; upper-arm length, tibial length, and knee height are all reliable and valid proxies for stature in children with cerebral palsy up to 12 years of age. We recommend that either knee height or tibial length be measured in the routine anthropometry of children with cerebral palsy who cannot be measured by standard techniques. Estimates of stature can then be calculated and plotted on standard growth charts.[2]

Ulna growth charts
The ulna measurement has been found to precisely predict height in school-age children and is more reliable than arm span measurement when neuromuscular weakness, joint, or spinal deformity exists.[3]

The following equations for height based on ulna length (U) and age in years (A) were developed using linear regression and the LMS Method.

Males: height (cm)=4.605U+1.308A+28.003 (R2=0.96)

Females: height (cm)=4.459U+1.315A+31.485 (R2=0.94)

Requirements for Energy Intake in Children with Neurological Impairment

There are no appropriate specific recommendations for assessing the energy needs of children with NI. Their requirements must be assessed individually, as their needs differ considerably, depending on mobility, muscle tone, activity level, altered metabolism and growth.

ESPGHAN recommends the use of dietary reference standards (DRI) for typically developing children in order to estimate the caloric needs of children with NI.

Note of caution: DRI may overestimate energy needs due to the severe growth delay and decreased physical activity of children with NI and, generally, patients with NI have lower body fat, muscle mass and protein.

General energy needs predictors

- Patients with NI require more energy for walking
- Patients dependent on a wheelchair require 60% to 70% energy, compared to healthy children
- Enterally fed children with NI show lower energy expenditure and high body fat content
- Children with spastic quadriplegia have lower energy expenditure than unaffected children; spasticity contributes 10% of total energy expenditure
- Increased feeding difficulties correlates with decreased nutritional status, relating to weight, body fat and arm muscle mass measurements
- Greatest predictor of energy needs is fat-free mass, followed by ambulatory status
- Total energy expenditure to resting expenditure ratio is estimated to be 1.5 or 1.6 for normal activity but can be as low as 1.1 in children with cerebral palsy quadriplegia

Energy Equations for Estimating Energy Requirements

Published equations have been found to underestimate energy needs in non-ambulant children by approximately 22%, yet overestimation of energy needs can lead to overweightedness, currently seen in up to 15% of children. However, ESPGHAN recommend the Schofield equation – for estimating calorie needs[4] and the Andrew et al. equation – for estimating energy requirements[5] as a starting point, but the effect of dietary intervention must also be continually reassessed.

Requirements and Recommendations for Protein and Fluids

Protein requirements for children with NI are similar to the protein requirements of unaffected children, except for tube-fed children. However, as body composition is altered in these children, their hydration status is impaired and requires close attention.

ENERGY	NI REQUIREMENTS	ESPGHAN RECOMMENDATION
Protein	Problems with protein intake arise when calorie needs are low, particularly in tube-fed children	Use dietary reference intake for protein in typically developing children to estimate the appropriate protein intake for children with NI
	Tube-fed, non-ambulant pre-school aged children have lower protein intakes compared with orally fed children	Supplementary protein should be taken in specific clinical situations such as decubitus ulcers or in children with low calorie requirement
Fluids	Children with NI may have impaired hydration status	Careful attention should be paid to hydration status, as dehydration is a risk due to inability to communicate thirst, drooling and unsafe swallowing

Requirements and Recommendations for Micronutrients

Micronutrient deficiencies, specifically; calcium, iron, zinc, vitamins C, D and E and selenium, are common, especially in children who are exclusively tube-fed. Many children with NI also require less energy to avoid being overweight and, as a consequence of a reduced energy intake, their micronutrient intake can be less than their daily requirements.

ESPGHAN MICRONUTRIENT RECOMMENDATION

DRI for micronutrients in typically developing children to be used to estimate the appropriate micronutrients intake for children with NI

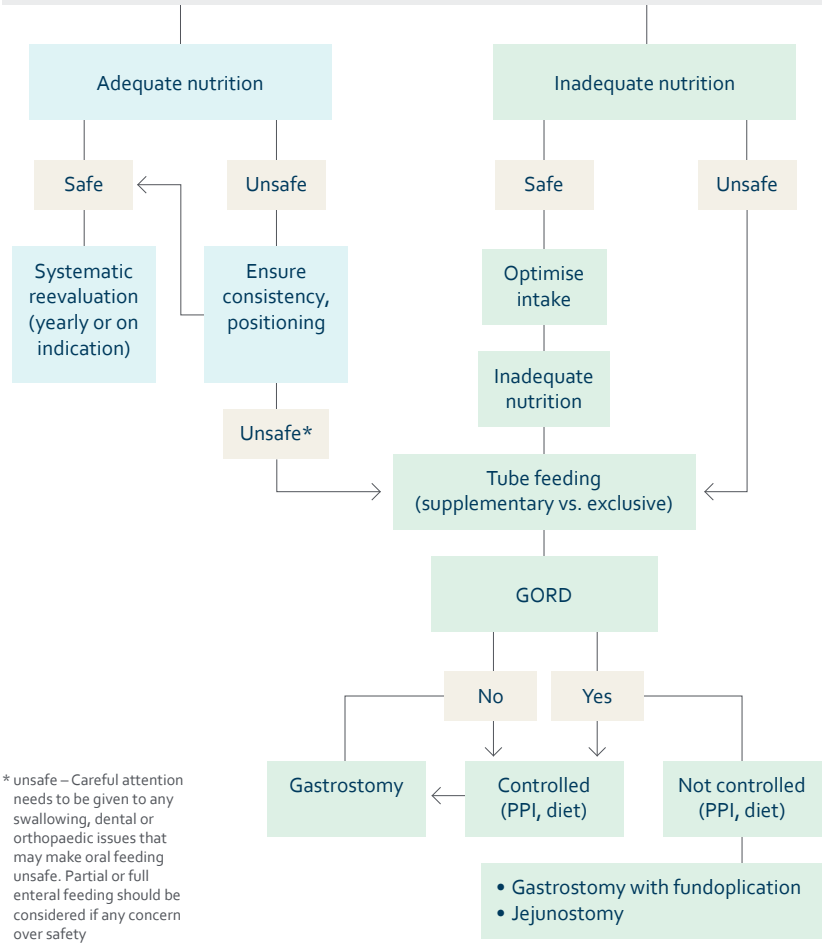
Iron supplementation to be used as first and diagnostic measure to treat children with iron deficiency

RDA of iron is:
10mg/day in children (7-10 years)
12mg/day adolescent boys (15-19 years)
15 mg/day in adolescent girls (15-19 years)

Recommendations for Nutritional Assessment

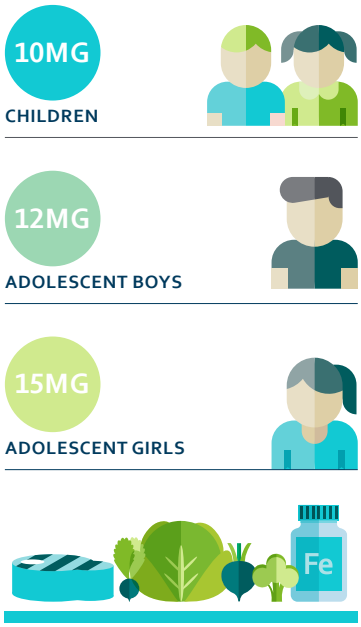
Multidisciplinary nutritional assessment of the neurologically impaired child:

- weight, length, triceps skinfold
- dietary history (e.g. meal duration)
- evaluation of oral motor function



* unsafe – Careful attention needs to be given to any swallowing, dental or orthopaedic issues that may make oral feeding unsafe. Partial or full enteral feeding should be considered if any concern over safety

RECOMMENDED DAILY AMOUNT OF IRON



References

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