

## **Evaluation and management of nutrition in children**

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### **GUIDELINES**

**No recommendations possible based on Level I or II evidence**

### **SUGGESTIONS FOR CLINICAL CARE**

(Suggestions are based on Level III and IV sources)

- **Measurements should be made at 1–3 month intervals of supine length or standing height and weight with comparison to normal values for chronological age using percentile charts, standard deviation scores (SDS) and body mass index (BMI).**
- **Nutrition assessment and counselling should take place at 1–3 month intervals.**
- **Serum albumin should be measured at 1–3 month intervals.**
- **Calculations of protein equivalent of nitrogen appearance (nPNA) are not reliable measures of dietary protein intake in children and should not replace nutritional assessment.**

### **Background**

Children with chronic kidney disease (CKD) or end-stage kidney disease (ESKD) frequently have growth retardation. Infants in particular, may demonstrate rapid falls in length SDS in the first 6 months of life, with little catch-up subsequently.

Height, weight, head circumference, skinfold thicknesses and serum albumin are commonly used as markers of nutrition in children with CKD or ESKD.

Nutritional assessment and counselling is regarded as mandatory in the management of children with CKD and ESKD, although it has proven difficult to find objective data to support this.

The objectives of this guideline are to review the available evidence for appropriate nutritional markers and for the value of nutritional assessment and counselling in children with CKD or ESKD.

## **Search strategy**

**Databases searched:** Medline (1996 to November Week 2 2003) and Embase (1980 to November 2003). MeSH terms for kidney disease were combined with MeSH terms and text words for nutrition assessment and management. The Cochrane Renal Group Specialised Register of randomised controlled trials was also searched for relevant trials not indexed in Medline.

**Date of searches:** 1 December 2003.

## **What is the evidence?**

No diagnostic test studies, which examined biochemical or anthropometric measurements for the evaluation of nutrition and growth in children with CKD or ESKD were identified. In addition, no randomised controlled trials (RCTs) evaluating nutritional assessment and counselling in these children were identified.

Expression of measurements in terms of SDS (observed measurement – expected measurement for 50<sup>th</sup> percentile for chronological age ÷ standard deviation of expected measurement) allows changes in rates of growth with time to be detected more easily than from observation of percentile charts. Head circumference should also be measured in children  $\leq$  3 years of age.

Measurements of skinfold thickness and mid-arm circumference and calculations of mid-arm muscle circumference reflect body fat and protein stores. There are no data to show that including these measurements in assessment assists nutritional intervention strategies over and above measurement of height and weight alone, although regular measurements of these parameters have been advocated (NKF, DOQI 2000).

Measurement of BMI is becoming part of the routine assessment of nutrition in paediatrics and age-dependent normal values are available for paediatric populations. BMI SDS have also been calculated for children with renal failure using reference data from Italian children after standardisation for the expected skewed distribution of reference values (Schaefer et al 2000). Values need to be standardised to height age, not chronological age.

In studies which reported stabilisation or improvement in growth parameters with nutritional intervention, nutritional assessment and counselling occurred monthly or more frequently (Coleman 1999, Kari et al 2000, Ledermann et al 1999, Tom et al 1999).

Serum albumin levels have been independently associated with mortality and morbidity in adults on peritoneal or haemodialysis (Leavey et al 1998, Churchill et al 1996). No similar data exist for children. Albumin levels in peritoneal dialysis (PD) patients are influenced by non-nutritional factors such as infection and PD losses. One-third of albumin measurements in 39 PD patients were below 29 g/L (Brem et al 2002). In contrast, none of 32 children on haemodialysis had low albumin levels (Brem et al 2002).

Low albumin levels after 1 month of PD have been associated with increased risk of recurrent peritonitis and of technique failure (Gulati et al 2001).

In adults, the calculated protein equivalent of nitrogen appearance (nPNA) or protein catabolic rate (nPCR) approximates dietary protein intake (DPI) under steady-state conditions so measurements of nPNA can be used as a measure of dietary protein intake. However, in children nPNA alone does not correlate with DPI in children on haemodialysis or PD (Grupe et al 1983, Schaefer et al 1994).

Daily protein intake or nitrogen intake calculated from dietary records correlates with but is significantly greater than that estimated from urine urea excretion (Orejas et al 1996, Wingen et al 1993).

In paediatric PD patients, total nitrogen appearance (TNA) correlates with but exceeds urine nitrogen appearance (UNA). However, TNA and thus PNA can be predicted from UNA when normalised to body weight and age (Mendley & Majkowski 2000).

In malnourished children on haemodialysis, calculated nPNA levels increase as children gain weight with nutritional supplementation while serum albumin levels do not change, suggesting that nPNA may be a more sensitive marker of malnutrition than serum albumin (Goldstein et al 2002).

Total body nitrogen (TBN) may offer an alternative way of assessing nitrogen uptake in children with renal failure and relating it to nutrition and growth (Baur et al 1994).

## **What do the other guidelines say?**

**Kidney Disease Outcomes Quality Initiative:** The most valid measures of protein and energy nutrition status in children treated with maintenance dialysis include dietary interview/diary/intensive nutritional counselling (Opinion), serum albumin (Opinion), height and weight (Evidence and Opinion), estimated dry weight (Opinion), weight/height index (Opinion), mid-arm circumference and muscle circumference or area (Opinion), skinfold thickness (Opinion), head circumference in 3 years or less (Evidence and Opinion), standard deviation score for height (Evidence and Opinion).

Scheduled, interval measurements of growth and nutrition parameters should be obtained to provide optimal care of the nutritional needs of children on maintenance peritoneal dialysis or haemodialysis. (Evidence and Opinion).

Urea kinetic modelling (UKM) may have a role in the nutritional assessment of children treated with maintenance dialysis. There is currently insufficient evidence to recommend the routine use of nPNA in paediatric patients. (Evidence and Opinion).

No recommendations for children with CKD.

**British Renal Association:** Measures of supine length or standing height and weight should be monitored at each clinic visit. Head circumference should be measured at each visit before two years of age and six monthly up to five years of age.

All children should undergo dietary assessment by a paediatric renal dietitian at a minimum of every three months, but more often if there is deteriorating biochemistry or growth.

UKM is hard to measure in children in whom urine collection and satisfactory estimations of total body water are difficult. The best parameter for assessing treatment adequacy in children is the rate of growth.

**Canadian Society of Nephrology:** No recommendations for children.

**European Best Practice Guidelines:** No recommendations for children.

### **Implementation and audit**

Serum albumin levels could be audited through members of the Australian & New Zealand Paediatric Nephrology Association (ANZPNA).

### **Suggestions for future research**

BMI SDS could be assessed in relation to height and weight as a measure of nutrition in children with renal failure.

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