CLINICAL PRACTICE GUIDELINES

Nutrition in CKD

UK Renal Association

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Introduction

Malnutrition in chronic kidney disease (CKD) is common but is often undiagnosed. This evidence-based clinical practice guideline summarises the main interventions that may be recommended in the prevention and management of undernutrition in this patient population. Undernutrition is a more frequent finding in established renal failure (ERF) (present in 30-40% of patients)[1] and is associated with reduced patient survival. The guideline authors regularly search Medline and reference lists from original and review articles to evaluate the nutrition literature and are familiar with the literature pertaining to nutrition and renal disease. The existing North American (K-DOQI 2000) and European guidelines on the assessment of nutrition in renal patients[2,3] were reviewed and primary sources examined as appropriate. This document offers a reinterpretation and update of those guidelines and incorporates recent UK Department of Health initiatives on nutritional screening[4].

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Summary of clinical practice guidelines for nutrition in CKD

1. Screening for undernutrition in CKD (Guidelines 1.1 – 1.2)

Guideline 1.1.1 – Screening methods for undernutrition in CKD

We recommend that all patients with stage 4-5 CKD should have the following parameters measured as a minimum in order to identify undernutrition (1C):

- Actual Body Weight (ABW) (< 85% of Ideal Body Weight (IBW))
- Reduction in oedema free body weight (of 5% or more in 3 months or 10% or more in 6 months)
- BMI (<20kg/m^2)
- Subjective Global Assessment (SGA) (B/C on 3 point scale or 1-5 on 7 point **scale**)

The above simple audit measures have been linked to increased mortality and other adverse outcomes.

Guideline 1.1.2 – Additional methods for assessment of undernutrition in CKD

We suggest that other measures including bioimpedance analysis, anthropometry, handgrip strength and assessment of nutrient intake can help to further assess nutritional state in those who are at risk of developing or have developed undernutrition (2B)

Low serum albumin is a strong predictor of adverse outcomes, but it is largely unrelated to nutritional status.

Guideline 1.2 – Frequency of screening for undernutrition in CKD

We recommend that screening should be performed (1D);

- Weekly for inpatients
- 2-3 monthly for outpatients with eGFR <20 but not on dialysis
- Within one month of commencement of dialysis then 6-8 weeks later
- 4-6 monthly for stable haemodialysis patients
- 4-6 monthly for stable peritoneal dialysis patients

Screening may need to occur more frequently if risk of undernutrition is increased (for example by intercurrent illness)

2. Prevention of undernutrition in CKD (Guidelines 2.1 – 2.6)

Guideline 2.1 – Dose of small solute removal to prevent undernutrition

We recommend that dialysis dose meets recommended solute clearance index guidelines (e.g. URR, Kt/V) (1C)

Guideline 2.2 – Correction of metabolic acidosis and nutrition

We recommend that venous bicarbonate concentrations should be maintained above 22 mmol/l (1C)

Guideline 2.3 – Minimum daily dietary protein intake

We suggest a prescribed protein intake of:

- 0.75 g/kg IBW/day for patients with stage 4-5 CKD not on dialysis
- 1.2 g/kg IBW/day for patients treated with dialysis (2B)

Recommended nutrient intakes are designed to ensure that 97.5% of a population take in enough protein and energy to maintain their body composition. There is variation in actual nutrient requirement between individuals. This means that some patients will be well maintained with lower nutrient intakes. Regular screening will help to identify when the dietary prescription needs to be amended.

Guideline 2.4 – Recommended daily energy intake

We suggest a prescribed energy intake of

- 30-35 kcal/kg IBW/day for all patients depending upon age and physical activity (2B)

Recommended nutrient intakes are designed to ensure that 97.5% of a population take in enough protein and energy to maintain their body composition. There is variation in actual nutrient requirement between individuals. This means that some patients will be well maintained with lower nutrient intakes. Regular screening will help to identify when the dietary prescription needs to be amended.

Guideline 2.5 – Vitamin supplementation in dialysis patients

We recommend that haemodialysis patients should be prescribed supplements of water soluble vitamins (1C).

Guideline 2.6 – Exercise programs in dialysis patients

We recommend that haemodialysis patients should be given the opportunity to participate in regular exercise programmes (1C).

Progressive resistance training and aerobic exercise have both been shown to bring about improvement in physical function and some components of Quality of Life scores.

3. Treatment of established undernutrition in CKD (Guidelines 3.1 – 3.6)

Guideline 3.1 – General treatment of established undernutrition

We recommend assessment by a physician to determine and treat possible underlying causes and by a specialist dietician to individualise dietary advice (1D)

Guideline 3.2 – Oral nutritional supplements in established undernutrition

We recommend the use of oral nutritional supplements if oral intake is below the levels indicated above and food intake cannot be improved following dietetic intervention (1C)

Guideline 3.3 – Enteral nutritional supplements in established undernutrition

We recommend the use of enteral feeding via NG tube / PEG if nutrient intake suboptimal despite oral supplements (1C)

Guideline 3.4 – Parenteral nutritional supplements in established undernutrition

We suggest intradialytic parenteral nutrition (IDPN) or intraperitoneal amino acids may be considered for selected cases if tube feeding is declined or clinically inappropriate (2D)

Guideline 3.5 – Anabolic agents in established undernutrition

We recommend that anabolic agents such as androgens, growth hormone or IGF-1. are not indicated in the treatment of undernutrition in adults (1D)

Androgens and growth hormone have demonstrated improvement in serum albumin levels and lean body mass but not mortality and these medications have significant side effects.

Guideline 3.6 – Supplementation of micronutrients in established undernutrition

We suggest that current evidence does not support the routine use of micronutrient supplements other than for identified clinical need (2C).

While deficiencies of fat soluble vitamins, trace elements and carnitine are prevalent in patients with chronic kidney disease current evidence does not support either preventative or therapeutic supplementation. However emerging evidence may suggest that supplementation of oral vitamin D (either cholecalciferol or ergocalciferol) is beneficial (2C).

4. Overnutrition in CKD

Guideline 4.1 – Monitoring overnutrition

We suggest that obesity can be assessed by BMI. (1C)

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Guideline 4.2 – Monitoring overnutrition

We suggest that waist and hip circumferences should not be collected routinely in CKD patients at this time. (2C)

Summary of Audit Measures:

1. Percentage of dialysis patients assessed by a renal dietician within the last 6 months

2. Percentage of dialysis patients with a dry weight of <85% ideal body weight

3. Percentage of stage 4/5 patients not on dialysis with a dry weight of <85% ideal body weight

4. Percentage of dialysis patients with a BMI <20kg/m2

5. Percentage of stage 4/5 patients not on dialysis with a BMI <20kg/m2

6. Percentage of dialysis patients assessed by SGA in the last 12 months

7. Percentage of stage 4/5 patients not on dialysis assessed by SGA in the last 12 months

8. Percentage of dialysis patients with an SGA score of B/C or 1-5 on a 7-point scale

9. Percentage of stage 4/5 patients not on dialysis with an SGA score of B/C or 1-5 on a 7-point scale

Rationale for clinical practice guidelines for nutrition in CKD

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- BMI (<20kg/m^2)
- Subjective Global Assessment (SGA) (B/C on 3 point scale or 1-5 on 7 point scale)

The above simple audit measures have been linked to increased mortality and other adverse outcomes.

Ideal body weight should be calculated from height and 'ideal' BMI. 'Ideal' would be:

- 20 for those with actual BMI < 20
- 25 for those with BMI > 25
- actual BMI if it lies between 20-25(1c)

Guideline 1.1.2 – Additional methods for assessment of undernutrition in CKD

We suggest that other measures including bioimpedance analysis, anthropometry, handgrip strength and assessment of nutrient intake can help to further assess nutritional state in those who are at risk of developing or have developed undernutrition (2B).

Low serum albumin is a strong predictor of adverse outcomes, but it is largely unrelated to nutritional status.

Guideline 1.2 – Frequency of screening for undernutrition in CKD

We recommend that screening should be performed (1D)

- Weekly for inpatients
- 2-3 monthly for outpatients with eGFR <20 but not on dialysis
- Within one month of commencement of dialysis then 6-8 weeks later
- 4-6 monthly for stable haemodialysis patients
- 4-6 monthly for stable peritoneal dialysis patients

Screening may need to occur more frequently if risk of undernutrition is increased (for example by intercurrent illness)

Audit measures

1. Percentage of dialysis patients assessed by a renal dietician within the last 6 months

2. Percentage of dialysis patients with a dry weight of <85% ideal body weight

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8. Percentage of dialysis patients with an SGA score of B/C or 1-5 on a 7-point scale

9. Percentage of stage 4/5 patients not on dialysis with an SGA score of B/C or 1-5 on a 7-point scale

Rationale of screening for undernutrition in CKD (1.1-1.2)

The principle development since the last set of Renal Association guidelines has been the production of nutrition guidelines by the Department of Health. This is intended to increase awareness of nutritional challenges faced by all patients. There are 10 markers of good nutritional care that UK hospitals should adhere to (Dept of Health 2007)[1]. These include:

1. Nutritional screening on admission and weekly thereafter
2. Individualised nutritional care plans
3. Recognising nutrition as a core part of a hospital's clinical governance plan
4. Patient involvement
5. Protected mealtimes
6. Ongoing staff education
7. Access to good nutrition for 24 hours every day of the week
8. Performance management of the hospital nutrition policy
9. Safe delivery of nutritional care
10. An MDT approach

Given the extra nutritional challenges faced by patients with renal failure, it is particularly important that these guidelines are implemented on renal wards. More guidance on how to screen for nutitional status is available from the National Institute of Clinical Excellence (National Collaborating Centre for Acute Care 2006)[2] who define malnutrition as:

1. a BMI <18.5 kg/m^2

2. an unintentional weight loss >10% in 3-6 months
3. BMI <20 kg/m^2 AND unintentional weight loss >5% in 3-6 months

The "Malnutrition Universal Screening Tool" (MUST) developed by the British Association of Parenteral and Enteral Nutrition is recommended by both NICE and the Department of Health for population screening. The risk of malnutrition is calculated from the combination of

1. BMI
    a. >20 = 0 points
    b. 18.5-20 = 1 point
    c. <18.5 = 2 points

2. Percentage unplanned weight loss of

    a. <5% = 0 points
    b. 5-10% = 1 point
    c. >10% = 2 points

3. Presence of acute illness and no nutritional intake for 5 days = 2 points

A score of 0 is defined as low risk, 1 medium risk and 2 or more high risk. Patients at medium risk should be monitored regularly. Patients with a high risk should be actively managed. This simple system has the advantage of being easily understood by all staff but BMI calculations are not always possible or are compromised in amputees and rapid changes of weight with water removal mean that an extra level of interpretation is needed for renal patients. There are modified screening tools used by some renal dieticians.

In dialysis populations, a number of other measures that at least partially reflect nutritional state predict worsened patient survival. These include serum creatinine (Lowrie and Lew 1990)[3] (creatinine is dependent on both renal function and muscle mass), serum cholesterol (Lowrie and Lew 1990)[3], serum albumin (Lowrie and Lew 1990[3], Blake et al 1993)[4], subjective global assessment (CANUSA 1996)[5], body mass index (Kopple et al 1999)[6], lean body mass (CANUSA 1996)[5], and handgrip strength (Heimburger et al 2000)[7]. This decrease in survival has been attributed to poor nutrition, however there is a strong correlation between inflammation, atherosclerosis and poor nutrition, referred to as the MIA complex (Stenvinkel 2001)[8]. The association between a low serum albumin and poor survival of dialysis patients predominantly reflects the association between serum albumin and inflammation (Kaysen et al 2000)[9], co-morbidity (Davies et al 1995)[10] and fluid overload (Jones 2001)[11].

As there is no single 'gold standard' measure of nutritional state, a panel of measurements should be used, reflecting the various aspects of protein-calorie nutrition.

A full nutritional assessment will include a medical history, assessment of dietary intake (by recall, 3-day food diary and measurement of protein equivalent of nitrogen appearance), anthropometric measures (mid-arm circumference, triceps skinfold

thickness and calculated mid-arm muscle circumference), and estimation of dialysis adequacy and of residual renal function. Subjective global assessment (SGA) includes gastrointestinal symptoms (appetite, anorexia, nausea, vomiting, diarrhoea), weight change in the preceding 6 months and last 2 weeks, evidence of functional impairment and a subjective visual assessment of subcutaneous tissue and muscle mass (Enia 1993)[12].

Serum albumin has been considered a marker of visceral protein and often used as a measure of nutritional state. Serum albumin is strongly predictive of mortality in pre-dialysis, dialysis and transplant populations. However the relationship between serum albumin and nutritional state is weak and in general causes other than malnutrition should be excluded (Jones et al 1997)[13]. Assessment might include C-reactive protein, evidence of atherosclerosis, 24-hour urinary protein loss, 24-hour peritoneal protein loss and determination of circulatory volume status by clinical examination and / or bio-electric impedance.

There is little evidence to guide the frequency of screening for dialysis patients. Assessment is needed at dialysis commencement to identify those who require nutritional supplementation as well as those who need water removal and to balance this with advice on the various dietary restrictions that may be necessary. After 6-8 weeks of dialysis, many patients have symptomatic relief and it may be that the dietary advice needs to change. For stable patients, nutritional changes are likely to be gradual after this. Mechanisms to detect patients that encounter a nutritional challenge between reviews need to be in place. The importance of multidisciplinary working between doctors, nurses and specialist dieticians in this regard cannot be over-emphasised.

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2. Prevention of undernutrition in CKD (Guidelines 2.1 – 2.6)

Guideline 2.1 – Dose of small solute removal to prevent undernutrition

We recommend that dialysis dose meets recommended solute clearance index guidelines (e.g. Kt/V) (1C)

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We recommend that venous bicarbonate concentrations should be maintained above 22 mmol/l (1C)

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We suggest a prescribed protein intake of:

- 0.75 g/kg IBW/day for patients with stage 4-5 CKD not on dialysis
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Recommended nutrient intakes are designed to ensure that 97.5% of a population take in enough protein and energy to maintain their body composition. There is variation in actual nutrient requirement between individuals. This means that some patients will be well maintained with lower nutrient intakes. Regular screening will help to identify when the dietary prescription needs to be amended.

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We suggest a prescribed energy intake of

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We recommend that haemodialysis patients should be prescribed supplements of water soluble vitamins (1C)

Guideline 2.6 – Exercise programs in dialysis patients

We recommend that haemodialysis patients should be given the opportunity to participate in regular exercise programmes (1C)

Progressive resistance training and aerobic exercise have both been shown to bring about improvement in physical function and some components of Quality of Life scores.

Rationale of prevention of undernutrition in CKD (2.1-2.6)

Many factors predispose to the development of undernutrition in patients with CKD. Some, such as changes in appetite, dental problems, vomiting and diarrhoea, may be identified through the patient's medical history. A decrease in appetite secondary to either uraemia or underdialysis should be confirmed with an assessment of dietary intake, residual renal function and dialysis dose. Dialysis treatment to current Kt/V or URR standards is associated with better nutrient intake than lower doses (Lindsay et al 1989 & Bergstrom et al 1993)[1,2]. Attempts to increase the small solute clearance further have not demonstrated progressive improvement (Davies et al 2000 & Rocco et al 2004)[3,4]. Protein intake can be obtained indirectly through the normalised equivalent of total protein nitrogen appearance (PNA) although this may give a spuriously high estimate in the presence of weight loss or active catabolism (Harty et al 1993)[5]. A variety of techniques are available for recording dietary intake; food intake records and dietary recall are the commonest. However many patients do not achieve these intakes and the consequences of this are not clear (Rocco et al 2002)[6].

Acidosis is an established catabolic factor (Garibotto et al 1994)[7] and the bicarbonate concentration of CAPD and HD patients should be maintained within target range to minimise this (Movilli et al 1998)[8]. Bicarbonate supplementation in the low clearance clinic may also retard the progression of renal failure (de Brito-Ashurst et al 2009)[9].

The recommended nutrient intakes are similar to those in other nutrition guidelines (KDOQI 2000 & Locatelli et al 2002)[10,11]. They are based on small studies of nitrogen balance. It is noted that recommended dietary intakes are set to ensure that 97.5% of a population take in enough protein and energy to maintain their body composition. There is variation in actual nutrient requirement between individuals. This means that some patients will be well maintained with lower nutrient intakes (Slomowitz et al 1989 & Bergstrom et al 1993)[3,12].

Data from the DOPPS shows that supplements of water soluble vitamins were not widely prescribed in UK units. They were associated with significantly lower mortality rates at patient and institution level. They are inexpensive and present a low

risk of toxicity, so we advise that their use should be more widespread (Fissell et al 2004)[13].

Regular exercise will increase lean body mass in healthy individuals. A number of studies of aerobic and progressive resistance training in dialysis patients have shown benefits in terms of cardiovascular performance and either muscle mass or function (see Cheema et al 2005 for a review and & Cheema et al 2007)[14,15]. The studies are disparate in terms of regime and end-point, but there are consistent messages that patients undergoing regular training improve their strength, exercise tolerance and have a better sense of well being on Quality of Life scores.

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3. Treatment of established undernutrition in CKD (Guidelines 3.1 – 3.6)

Guideline 3.1 – General treatment of established undernutrition

We recommend assessment by a physician to determine and treat possible underlying causes and by a specialist dietician to individualise dietary advice (1D)

Guideline 3.2 – Oral nutritional supplements in established undernutrition

We recommend the use of oral nutritional supplements if oral intake is below the levels indicated above and food intake cannot be improved following dietetic intervention (1C)

Guideline 3.3 – Enteral nutritional supplements in established undernutrition

We recommend the use of enteral feeding via NG tube / PEG if nutrient intake suboptimal despite oral supplements (1C)

Guideline 3.4 – Parenteral nutritional supplements in established undernutrition

We suggest intradialytic parenteral nutrition (IDPN) or intraperitoneal amino acids may be considered for selected cases if tube feeding is declined or clinically inappropriate (2D).

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We recommend that anabolic agents such as androgens, growth hormone or IGF-1. are not indicated in the treatment of undernutrition in adults (1D).

Androgens and growth hormone have demonstrated improvement in serum albumin levels and lean body mass but not mortality and these medications have significant side effects.

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While deficiencies of fat soluble vitamins, trace elements and carnitine are prevalent in patients with chronic kidney disease current evidence does not support either preventative or therapeutic supplementation. However emerging evidence may suggest that supplementation of oral vitamin D (either cholecalciferol or ergocalciferol) is beneficial (2C).

Rationale of treatment of established undernutrition in CKD (3.1-3.6)

There is a paucity of well conducted research examining the management of malnutrition in dialysis patients. Ideally worsening nutrition should be identified early and proactively managed. Correcting established malnutrition is difficult. All reversible factors (including inflammation and occult sepsis) should be identified and corrected. Initiation of dialysis may be required in pre-dialysis patients and dialysis treatment should be optimised. Increased dialysis dose (Ikizler et al 1996), the use of biocompatible membranes (Parker et al 1996;49:551) and provision of ultrapure water (Shiffl et al 2001) are dialysis related factors that have been associated with improved nutritional state[1-3], although there are no longitudinal studies in overtly malnourished subjects. Serum bicarbonate should be within the recommended range (Stein et al 1997)[4].

Dietary intake should be enhanced with ordinary foods or oral supplements (Steinvinkel 2005)[5]. In patients not responding to adequate dialysis and optimisation of oral intake enteral feeding may be required (Stratton et al 2005)[6], either by nasogastric tube or percutaneous endoscopic gastrostomy. Intradialytic parenteral nutrition (in haemodialysis) (Foulks 1999)[7] and intraperitoneal amino acid supplementation (PD) (Jones et al 1998)[8] can be considered, although evidence of benefit is limited (Cano 2007)[9]. Pharmacological therapies include subcutaneous growth hormone (Johannsson et al 1999), insulin-like growth factor (Fouque et al 2000) and oral androgens (Barton et al 2002)[10-12]. Again evidence of benefit is limited. All of these interventions are expensive and are associated with potentially serious side effects. Their use should be guided by local protocols with monitoring of nutritional state to demonstrate benefit.

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4. Overnutrition in CKD

Guideline 4.1 – Monitoring overnutrition

We suggest that obesity in CKD can be assessed by BMI. (1C)

Deleted: 2

Guideline 4.2 – Monitoring overnutrition

We suggest that waist and hip circumferences should not be collected routinely in CKD patients at this time. (2C)

Rationale

This guideline focuses on undernutrition but it is recognised that the population with established renal failure has shown a demographic shift from predominant undernutrition to overnutrition (Kramer 2006).[1] Obesity is a recognised risk factor for the development of cardiovascular disease, type 2 diabetes mellitus and CKD (Ritz 2008)[2] in the general population. The importance of obesity in the established renal failure population is less clear cut. Paradoxically obesity is associated with increased survival in dialysis patients (Leavey 2001).[3] However, most clinicians would still consider obesity as an undesirable trait in established renal failure and stage 3-4 CKD patients. Body mass index (BMI) has long been accepted as the main indicator of obesity. However the validity of BMI has been challenged and waist to hip ratio suggested as a more useful measure. Waist to hip ratio was associated with an increased risk of myocardial infarction and fatal coronary artery disease in patients with CKD (Elsayed 2008).[4] Whereas there are currently no studies indicating a strong relationship between waist to hip ratio and mortality in established renal failure the National Renal Data Set lists BMI, waist circumference and hip circumference as mandatory variables.

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