

# Chronic kidney disease (stage 4 or 5): management of hyperphosphataemia

Clinical guideline

Published: 13 March 2013

[nice.org.uk/guidance/cg157](https://www.nice.org.uk/guidance/cg157)

## Your responsibility

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

Local commissioners and providers of healthcare have a responsibility to enable the guideline to be applied when individual professionals and people using services wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with complying with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

## Contents

Introduction .....	4
Hyperphosphataemia .....	4
Who this guideline is for.....	5
Patient-centred care.....	7
1 Recommendations .....	8
1.1 List of all recommendations .....	8
2 List of all research recommendations .....	11
2.1 Phosphate binders in adults with CKD stage 4 or 5 .....	11
2.2 Effectiveness and safety of aluminium hydroxide in adults.....	11
2.3 Effectiveness and safety of magnesium carbonate in adults .....	11
2.4 Phosphate binders in children.....	12
2.5 Sequencing and combining of phosphate binders in adults.....	12
3 Other information.....	14
3.1 Scope and how this guideline was developed .....	14
3.2 Related NICE guidance.....	14
4 The Guideline Development Group and NICE project team.....	15
4.1 The Guideline Development Group .....	15
4.2 Internal Clinical Guidelines Technical Team .....	16
4.3 NICE Centre for Clinical Practice.....	16
About this guideline .....	18
Strength of recommendations.....	18
Other versions of this guideline .....	19
Implementation .....	19
Changes after publication.....	19
Your responsibility.....	19
Copyright.....	20
Contact NICE.....	20

## Introduction

### *Hyperphosphataemia*

Chronic kidney disease (CKD) describes abnormal kidney function and/or structure. It is common and often exists together with other conditions, such as cardiovascular disease and diabetes.

The 'National service framework for renal services' adopted the US 'National Kidney Foundation kidney disease outcomes quality initiative' (NKF-KDOQI) classification of CKD. This classification divides CKD into 5 stages according to the extent of a person's loss of renal function. Stage 4 CKD is defined by a glomerular filtration rate (GFR) of 15–29 ml/min/1.73 m<sup>2</sup>, and stage 5 by a GFR of less than 15 ml/min/1.73 m<sup>2</sup>.<sup>[1]</sup>

CKD progresses to these more advanced stages in a small, but significant percentage of people. In 2010, the Health Survey for England reported a prevalence of moderate to severe CKD (stages 3 to 5) of 6% in men and 7% in women, as a percentage of the total population in England. CKD stages 4 and 5 were reported at a prevalence of 1% or less. Although this figure might seem small, it translates to a prevalence of up to 520,000 people in England alone.

When CKD stage 5 advances to end-stage renal disease (ESRD), some people progress to renal replacement therapy (RRT)<sup>[2]</sup>. The UK Renal Registry reported that 49,080 adult patients were receiving RRT in the UK at the end of 2009. Of these, 25,796 were receiving RRT in the form of dialysis (a population sometimes classified CKD stage 5D).

As kidney dysfunction advances, there is a higher risk of mortality and some comorbidities become more severe. Hyperphosphataemia is one example of this, and occurs because of insufficient filtering of phosphate from the blood by poorly functioning kidneys. This means that a certain amount of the phosphate does not leave the body in the urine, instead remaining in the blood at abnormally elevated levels.

High serum phosphate levels can directly and indirectly increase parathyroid hormone secretion, leading to the development of secondary hyperparathyroidism. Left untreated, secondary hyperparathyroidism increases morbidity and mortality and may lead to renal bone disease, with people experiencing bone and muscular pain, increased incidence of fracture, abnormalities of bone and joint morphology, and vascular and soft tissue calcification.

For adults with stage 4 or 5 CKD who are not on dialysis, the UK Renal Association guidelines recommend that serum phosphate be maintained at between 0.9 and 1.5 mmol/l. For adults with

stage 5 CKD who are on dialysis, it is recommended that serum phosphate levels be maintained at between 1.1 and 1.7 mmol/l. Because of the improved removal of phosphate from the blood through dialysis, adults on dialysis have different recommended levels to those with stage 4 or 5 CKD who are not on dialysis.

For children and young people with stage 4 CKD, the NKF-KDOQI guidelines and European guidelines on the prevention and treatment of renal osteodystrophy recommend that serum phosphate be maintained within age-appropriate limits. For those with stage 5 CKD, including those on dialysis, it is recommended that serum phosphate levels be maintained at between 1.3 and 1.9 mmol/l for those aged 1–12 years, and between 1.1 and 1.8 mmol/l during adolescence.

Standard management of hyperphosphataemia involves the use of both pharmacological and non-pharmacological interventions, as well as the provision of education and support. However, there is wide variation between units and practices across the UK in how these interventions are used. At the end of 2009, data from the UK Renal Registry showed that only 61% of patients receiving haemodialysis and 70% of patients receiving peritoneal dialysis achieved serum phosphate levels within the recommended range. This, together with a rising prevalence of CKD, led to the development of this clinical guideline on the management of hyperphosphataemia.

The guideline will assume that prescribers will use a drug's summary of product characteristics to inform decisions made with individual patients.

This guideline recommends some drugs for indications for which they do not have a UK marketing authorisation at the date of publication, if there is good evidence to support that use. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. The patient (or those with authority to give consent on their behalf) should provide informed consent, which should be documented. See the General Medical Council's [Good practice in prescribing and managing medicines and devices](#) for further information. Where recommendations have been made for the use of drugs outside their licensed indications ('off-label use'), these drugs are marked with a footnote in the recommendations.

### *Who this guideline is for*

This document is for healthcare professionals and other staff who care for people with stage 4 or 5 CKD, including those with stage 5 CKD who are on dialysis. This includes primary, secondary and tertiary care settings. Where it refers to children and young people, this applies to all people younger than 18 years. Where it refers to adults, this applies to all people 18 years or older.

<sup>[1]</sup> A GFR of over 90 ml/min/1.73 m<sup>2</sup> is considered normal unless there is other evidence of kidney disease.

<sup>[2]</sup> Note: in this guideline, those who choose not to participate in an active treatment programme for their ESRD (which would generally include RRT, diet, pain management etc), instead opting for 'conservative management', are considered to be a subset of the stage 5 population who are not on dialysis.

## Patient-centred care

This guideline offers best practice advice on the care of adults, children and young people with stage 4 or 5 CKD who have, or are at risk of, hyperphosphataemia.

Patients and healthcare professionals have rights and responsibilities as set out in the [NHS Constitution for England](#) – all NICE guidance is written to reflect these. Treatment and care should take into account individual needs and preferences. Patients should have the opportunity to make informed decisions about their care and treatment, in partnership with their healthcare professionals. If someone does not have the capacity to make decisions, healthcare professionals should follow the [Department of Health's advice on consent](#), the [code of practice that accompanies the Mental Capacity Act](#) and the [supplementary code of practice on deprivation of liberty safeguards](#). In Wales, healthcare professionals should follow [advice on consent from the Welsh Government](#).

If the patient is under 16, healthcare professionals should follow the guidelines in the Department of Health's [Seeking consent: working with children](#). Families and carers should also be given the information and support they need to help the child or young person in making decisions about their treatment.

NICE has produced guidance on the components of good patient experience in adult NHS services. All healthcare professionals should follow the recommendations in [Patient experience in adult NHS services](#).

If a young person is moving between paediatric and adult services, care should be planned and managed according to the best practice guidance described in the Department of Health's [Transition: getting it right for young people](#).

Adult and paediatric healthcare teams should work jointly to provide assessment and services to young people with hyperphosphataemia. Diagnosis and management should be reviewed throughout the transition process, and there should be clarity about who is the lead clinician to ensure continuity of care.

## 1 Recommendations

The following guidance is based on the best available evidence. The [full guideline](#) gives details of the methods and the evidence used to develop the guidance.

The wording used in the recommendations in this guideline (for example, words such as 'offer' and 'consider') denotes the certainty with which the recommendation is made (the strength of the recommendation). See [About this guideline](#) for details.

### 1.1 *List of all recommendations*

#### **Dietary management: children, young people and adults**

- 1.1.1 A specialist renal dietitian, supported by healthcare professionals with the necessary skills and competencies, should carry out a dietary assessment and give individualised information and advice on dietary phosphate management.
- 1.1.2 Advice on dietary phosphate management should be tailored to individual learning needs and preferences, rather than being provided through a generalised or complex multicomponent programme of delivery.
- 1.1.3 Give information about controlling intake of phosphate-rich foods (in particular, foods with a high phosphate content per gram of protein, as well as food and drinks with high levels of phosphate additives) to control serum phosphate, while avoiding malnutrition by maintaining a protein intake at or above the minimum recommended level. For people on dialysis, take into account possible dialysate protein losses.
- 1.1.4 If a nutritional supplement is needed to maintain protein intake in children and young people with hyperphosphataemia, offer a supplement with a lower phosphate content, taking into account patient preference and other nutritional requirements.

#### **Phosphate binders: children and young people**

- 1.1.5 For children and young people, offer a calcium-based phosphate binder as the first-line phosphate binder to control serum phosphate in addition to dietary management.



- 1.1.6 For children and young people, if a series of serum calcium measurements shows a trend towards the age-adjusted upper limit of normal, consider a calcium-based binder in combination with sevelamer hydrochloride<sup>[3]</sup>, having taken into account other causes of rising calcium levels.
- 1.1.7 For children and young people who remain hyperphosphataemic despite adherence to a calcium-based phosphate binder, and whose serum calcium goes above the age-adjusted upper limit of normal, consider either combining with, or switching to, sevelamer hydrochloride<sup>[3]</sup>, having taken into account other causes of raised calcium.

### Phosphate binders: adults

- 1.1.8 For adults, offer calcium acetate as the first-line phosphate binder to control serum phosphate in addition to dietary management.
- 1.1.9 For adults, consider calcium carbonate if calcium acetate is not tolerated or patients find it unpalatable.
- 1.1.10 For adults with stage 4 or 5 chronic kidney disease (CKD) who are not on dialysis and who are taking a calcium-based binder:
- consider switching to a non-calcium-based binder if calcium-based phosphate binders are not tolerated
  - consider either combining with, or switching to, a non-calcium-based binder if hypercalcaemia develops (having taken into account other causes of raised calcium), or if serum parathyroid hormone levels are low.
- 1.1.11 For adults with stage 5 CKD who are on dialysis and remain hyperphosphataemic despite adherence to the maximum recommended or tolerated dose of calcium-based phosphate binder, consider either combining with, or switching to, a non-calcium-based binder.
- 1.1.12 For adults with stage 5 CKD who are on dialysis and who are taking a calcium-based binder, if serum phosphate is controlled by the current diet and phosphate binder regimen but:
- serum calcium goes above the upper limit of normal, or

- serum parathyroid hormone levels are low,

consider either combining with, or switching to, sevelamer hydrochloride or lanthanum carbonate, having taken into account other causes of raised calcium.

## Phosphate binders: children, young people and adults

- 1.1.13 If a combination of phosphate binders is used, titrate the dosage to achieve control of serum phosphate while taking into account the effect of any calcium-based binders used on serum calcium levels (also see recommendations [1.1.6](#), [1.1.7](#) and [1.1.10–1.1.12](#)).
- 1.1.14 Take into account patient preference and the ease of administration, as well as the clinical circumstances, when offering a phosphate binder in line with recommendations [1.1.5–1.1.12](#).
- 1.1.15 Advise patients (or, as appropriate, their parents and/or carers) that it is necessary to take phosphate binders with food to control serum phosphate.

## Review of treatments: children, young people and adults

- 1.1.16 At every routine clinical review, assess the patient's serum phosphate control, taking into account:
- dietary phosphate management
  - phosphate binder regimen
  - adherence to diet and medication
  - other factors that influence phosphate control, such as vitamin D or dialysis.

---

<sup>[3]</sup> Although this use is common in UK clinical practice, at the time of publication (March 2013), sevelamer hydrochloride did not have a UK marketing authorisation for use in children for this indication. The prescriber should follow relevant professional guidance, taking full responsibility for the decision. The patient should provide informed consent, which should be documented. See the General Medical Council's [Good practice in prescribing and managing medicines and devices](#) for further information.

## 2 List of all research recommendations

The Guideline Development Group has made the following recommendations for research, based on its review of evidence, to improve NICE guidance and patient care in the future.

### 2.1 *Phosphate binders in adults with CKD stage 4 or 5*

Which binders are most effective in controlling serum phosphate in adults with stage 4 or 5 CKD who are not on dialysis?

#### **Why this is important**

Limited evidence was found on the use of phosphate binders in adults with stage 4 or 5 CKD. While it is possible in some instances to extrapolate from the evidence on people with stage 5 CKD who are on dialysis, it is not ideal. Therefore, a series of RCTs should be conducted to examine the comparative effectiveness of various phosphate binders against each other for the management of serum phosphate in adults with stage 4 or 5 CKD. These trials should examine the long-term (ideally 12-month) effects of the various binders on outcomes such as serum phosphate, serum calcium, adverse events and the ability of the binders to control serum phosphate and calcium within the given ranges.

### 2.2 *Effectiveness and safety of aluminium hydroxide in adults*

In adults with stage 4 or 5 CKD, including those on dialysis, what is the long-term effectiveness and safety of aluminium hydroxide in controlling serum phosphate?

#### **Why this is important**

Limited evidence was found on the efficacy of aluminium hydroxide in adults and no evidence was found on the long-term efficacy and safety of aluminium hydroxide. A series of RCTs should be conducted separately in adults with stages 4 or 5 CKD who are not on dialysis and those with stage 5 who are on dialysis. These trials should be run for a minimum of 12 months and should examine the effect of aluminium hydroxide on outcomes such as serum phosphate, serum calcium, adverse events and the ability of the binders to control serum phosphate and calcium within the given ranges. In addition, specific data should be collected on aspects relating to aluminium toxicity.

### 2.3 *Effectiveness and safety of magnesium carbonate in adults*

In adults with stage 4 or 5 CKD, including those on dialysis, what is the long-term effectiveness and

safety of magnesium carbonate in controlling serum phosphate?

### **Why this is important**

Limited evidence was found on the use of magnesium carbonate to control serum phosphate. However, the evidence that was assessed suggested that magnesium carbonate could be very effective in controlling serum phosphate. A series of RCTs should be conducted separately in adults with stages 4 or 5 CKD who are not on dialysis and those with stage 5 who are on dialysis. These trials should be run for a minimum of 12 months and should examine the effect of magnesium carbonate on outcomes such as serum phosphate, serum calcium, adverse events and the ability of the binders to control serum phosphate and calcium within the given ranges. In addition, specific data should be collected on aspects relating to magnesium toxicity.

## **2.4 *Phosphate binders in children***

Which binders are most effective in controlling serum phosphate in children with stage 4 or 5 CKD, including those who are on dialysis?

### **Why this is important**

Limited evidence was found on the use of phosphate binders in children with stage 5 CKD who are on dialysis, and none was found for those with stage 4 or 5 CKD who are not on dialysis. Therefore, a series of RCTs should be conducted that examine the comparative effectiveness of various phosphate binders against each other for the management of serum phosphate. These RCTs should be conducted separately in those with stages 4 or 5 CKD who are not on dialysis and those with stage 5 who are on dialysis. These trials should examine the long-term (ideally 12-month) effects of the various binders on outcomes such as serum phosphate, serum calcium, adverse events and the ability of the binders to control serum phosphate and calcium within the given ranges, as well as the most appropriate sequencing of binders.

## **2.5 *Sequencing and combining of phosphate binders in adults***

For adults with stage 4 or 5 CKD, including those on dialysis, what is the most effective sequence or combination of phosphate binders to control serum phosphate?

### **Why this is important**

It is thought that the longer people remain on calcium-based binders, the greater their risk of developing hypercalcaemia. However, no evidence was found on the most appropriate sequence or

combination of phosphate binders a person should receive to control serum phosphate and serum calcium. A series of RCTs should be conducted separately in adults with stages 4 or 5 CKD who are not on dialysis and those with stage 5 who are on dialysis. These trials should be run for a minimum of 12 months and should examine comparative effectiveness of various sequences and combinations of available phosphate binders on outcomes such as serum phosphate, serum calcium, adverse events and the ability of the binders to control serum phosphate and calcium within the given ranges.

## 3 Other information

### 3.1 *Scope and how this guideline was developed*

NICE guidelines are developed in accordance with a [scope](#) that defines what the guideline will and will not cover.

### 3.2 *Related NICE guidance*

Details are correct at the time of publication (Mar 2013). Further information is available on the [NICE website](#).

## Published

### *General*

- [Patient experience in adult NHS services](#). NICE clinical guidance 138 (2012).
- [Medicines adherence](#). NICE clinical guidance 76 (2009).

### *Condition-specific*

- [Peritoneal dialysis](#). NICE clinical guideline 125 (2011).
- [Anaemia management in people with chronic kidney disease](#). NICE clinical guideline 114 (2011).
- [Chronic kidney disease](#). NICE clinical guideline 73 (2008).
- [Cinacalcet for the treatment of secondary hyperparathyroidism in patients with end-stage renal disease on maintenance dialysis therapy](#). NICE technology appraisal guidance 117 (2007).

## Under development

NICE is developing the following guidance (details available from the [NICE website](#)):

- [Acute kidney injury](#). NICE clinical guideline. Publication expected August 2013.
- [Chronic kidney disease \(update\)](#). NICE clinical guideline. Publication expected July 2014.

## **4 The Guideline Development Group and NICE project team**

### **4.1 *The Guideline Development Group***

**Gary McVeigh (Chair)**

Professor of Cardiovascular Medicine, Queen's University Belfast

**David Bennett-Jones**

Consultant – Renal Medicine, University Hospitals Coventry and Warwickshire

**Shelley Cleghorn**

Principal Paediatric Nephrology Dietitian, Great Ormond Street Hospital for Children

**Roy Connell**

Clinical Nurse Specialist – Paediatric dialysis, Nottingham University Hospital

**Indranil Dasgupta**

Consultant Physician and Nephrologist, Birmingham Heartlands Hospital

**Sylvia Grace**

Renal Dietitian, University Hospitals Coventry and Warwick NHS Trust

**Clair Huckerby**

Pharmaceutical Adviser – Medicines Management Lead, NHS Dudley

**Nora Kerigan**

Dialysis Adequacy Practitioner, Lancashire Teaching Hospitals NHS Trust

**Fiona Loud**

Patient and carer member, The Kidney Alliance

**Nicholas Palmer**

Patient and carer member, National Kidney Federation

**Rukshana Shroff**

Consultant in Paediatric Nephrology, Great Ormond Street Hospital for Children

## 4.2 *Internal Clinical Guidelines Technical Team*

An Internal Clinical Guidelines Technical team was responsible for this guideline throughout its development. It prepared information for the Guideline Development Group, drafted the guideline and responded to consultation comments.

**Emma Banks**  
Project Manager

**Mendwas Dzingina**  
Technical Analyst (Health Economics)

**Sarah Glover**  
Information Specialist

**Michael Heath**  
Programme Manager

**Lucy Hoppe**  
Assistant Technical Analyst

**Dylan Jones**  
Technical Adviser

**Gabriel Rogers**  
Technical Adviser (Health Economics)

## 4.3 *NICE Centre for Clinical Practice*

**Laura Donegani**  
Guideline Commissioning Coordinator

**Louise Millward**  
Associate Director

**Sarah Palombella**  
Editor



**Rachel Ryle**

Guideline Commissioning Manager

**Judith Thornton**

Technical Lead

**Erin Whittingham**

Assistant Project Manager, Patient and Public Involvement Programme

## About this guideline

NICE clinical guidelines are recommendations about the treatment and care of people with specific diseases and conditions in the NHS in England and Wales.

NICE guidelines are developed in accordance with a [scope](#) that defines what the guideline will and will not cover.

This guideline was developed by the NICE Internal Clinical Guidelines Programme. The Internal Clinical Guidelines Programme worked with a Guideline Development Group, comprising healthcare professionals (including consultants, GPs and nurses), patients and carers, and technical staff, which reviewed the evidence and drafted the recommendations. The recommendations were finalised after public consultation.

The methods and processes for developing NICE clinical guidelines are described in [The guidelines manual](#). This guideline was developed using the short clinical guideline process.

## *Strength of recommendations*

Some recommendations can be made with more certainty than others. The Guideline Development Group makes a recommendation based on the trade-off between the benefits and harms of an intervention, taking into account the quality of the underpinning evidence. For some interventions, the Guideline Development Group is confident that, given the information it has looked at, most patients would choose the intervention. The wording used in the recommendations in this guideline denotes the certainty with which the recommendation is made (the strength of the recommendation).

For all recommendations, NICE expects that there is discussion with the patient about the risks and benefits of the interventions, and their values and preferences. This discussion aims to help them to reach a fully informed decision (see also [Patient-centred care](#)).

## **Interventions that must (or must not) be used**

We usually use 'must' or 'must not' only if there is a legal duty to apply the recommendation. Occasionally we use 'must' (or 'must not') if the consequences of not following the recommendation could be extremely serious or potentially life threatening.

## **Interventions that should (or should not) be used – a 'strong' recommendation**

We use 'offer' (and similar words such as 'refer' or 'advise') when we are confident that, for the vast majority of patients, an intervention will do more good than harm, and be cost effective. We use similar forms of words (for example, 'Do not offer...') when we are confident that an intervention will not be of benefit for most patients.

## **Interventions that could be used**

We use 'consider' when we are confident that an intervention will do more good than harm for most patients, and be cost effective, but other options may be similarly cost effective. The choice of intervention, and whether or not to have the intervention at all, is more likely to depend on the patient's values and preferences than for a strong recommendation, and so the healthcare professional should spend more time considering and discussing the options with the patient.

## *Other versions of this guideline*

The full guideline, [Management of hyperphosphataemia in patients with stage 4 or 5 chronic kidney disease](#), contains details of the methods and evidence used to develop the guideline. It is published by the Internal Clinical Guidelines Programme.

The recommendations from this guideline have been incorporated into a

We have produced [information for the public](#) about this guideline.

## *Implementation*

[Implementation tools and resources](#) to help you put the guideline into practice are also available.

## *Changes after publication*

May 2013: minor modification.

## *Your responsibility*

This guidance represents the view of NICE, which was arrived at after careful consideration of the evidence available. Healthcare professionals are expected to take it fully into account when exercising their clinical judgement. However, the guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of

the individual patient, in consultation with the patient and/or guardian or carer, and informed by the summaries of product characteristics of any drugs.

Implementation of this guidance is the responsibility of local commissioners and/or providers. Commissioners and providers are reminded that it is their responsibility to implement the guidance, in their local context, in light of their duties to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity and foster good relations. Nothing in this guidance should be interpreted in a way that would be inconsistent with compliance with those duties.

## *Copyright*

© National Institute for Health and Clinical Excellence 2013. All rights reserved. NICE copyright material can be downloaded for private research and study, and may be reproduced for educational and not-for-profit purposes. No reproduction by or for commercial organisations, or for commercial purposes, is allowed without the written permission of NICE.

## *Contact NICE*

National Institute for Health and Clinical Excellence  
Level 1A, City Tower, Piccadilly Plaza, Manchester M1 4BT

[www.nice.org.uk](http://www.nice.org.uk)

[nice@nice.org.uk](mailto:nice@nice.org.uk)

0845 033 7780

ISBN 978-1-4731-0053-4

## Accreditation

