

THE RENAL ASSOCIATION

# Treatment of adults and children with renal failure

**Standards and audit measures**

THIRD EDITION

Prepared by the Standards and Audit Subcommittee of the Renal Association on behalf of  
the RENAL ASSOCIATION and the ROYAL COLLEGE OF PHYSICIANS OF LONDON  
in collaboration with the BRITISH TRANSPLANTATION SOCIETY, the INTENSIVE CARE SOCIETY  
and the BRITISH ASSOCIATION OF PAEDIATRIC NEPHROLOGISTS

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# Summary of standards

## 2 Epidemiology of chronic renal failure and renal replacement therapy

What is the level of population need for renal replacement therapy ?

### *Standards*

- ▶ While it is difficult to be precise about the level of national need for renal replacement therapy (RRT), a realistic figure is an acceptance rate of at least 120–130 pmp. **(B)**
- ▶ It is likely that a minimum level of 100 pmp would apply to all health authorities/boards. **(B)**

Measuring RRT rates

### *Standard*

- ▶ The Renal Registry definition of acceptance should be used in all units. **(C)**

### *Recommendation*

- ▶ Each health authority/health board should assess its likely need for RRT in the light of the characteristics of the local population. These rates should be age and sex standardised and in future be standardised for ethnic minority populations, using 2002 Census data on health authority ethnic composition and Registry data on ethnicity. Such recording should be encouraged. **(Good statistical practice)**

90-day rule

### *Recommendation*

- ▶ To allow meaningful comparison, UK performance should be analysed not only from the day of starting uninterrupted dialysis (day 0) but also from day 90. **(Good statistical practice)**

Late referral

### *Recommendations*

- ▶ All renal units should audit late referrals to identify avoidable factors and any scope for improving the interface between primary and secondary care providers. **(Good practice)**
- ▶ Data should be provided to the Renal Registry on date of first referral to the renal unit, and unplanned dialysis, so that the national pattern of late referral and its variation can be established. **(Good epidemiological practice)**

**Analysing survival on RRT**

**Recommendations**

- ▶ All units registered with the Registry should endeavour to supply co-morbidity data on newly accepted patients. The priority should be diabetes as a cause of end stage renal disease (ESRD) and evidence of coronary heart disease or peripheral vascular disease. **(Good practice)**
  - ▶ Survival analyses must at least take account of age, gender, diabetes and co-morbidity. **(C)**
  - ▶ The Karnofsky performance status is a simple measure that could be collected on incident and prevalent patients and used in survival analyses. **(B)**
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### 3 Haemodialysis – clinical standards and targets

**Dialysis equipment and disposables\***

**Standards**

- ▶ All equipment used in the delivery and monitoring of therapy should comply with the relevant Standards for medical electrical equipment (BS-EN 60601-2-16: 1998, BS5724-2-16:1998. Medical electrical equipment. Particular requirements for safety. Particular requirements for the safety of haemodialysis (HD), haemodiafiltration and haemofiltration equipment). **(Good practice)**
  - ▶ Disposables such as dialysers and associated devices are classified as medical devices and should display the CE mark. The presence of such a mark signifies compliance with the national and international standards: haemodialysers, haemodiafilters, haemofilters, haemoconcentrators and their extra corporeal circuits (BS-EN 1283: 1996). Plasma filters (BS/150 13960).
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**Recommendation**

- ▶ Machines should be considered for replacement after seven years' service or after completing 50,000 hours operation, whichever is first. **(Good practice)**
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**Concentrates and water for dialysis**

**Standards**

- ▶ Concentrates used, either purchased ready-made or manufactured 'in house' must meet the requirements of prEN 13867: 2002 (concentrates for HD and related therapies). **(Good practice)**
  - ▶ Water used in preparation of dialysis fluid must meet the requirements of BS ISO 13959 2001 (water for HD and related therapies) for bacterial and chemical contaminants. If routine monitoring demonstrates continuous excess contamination, a phased programme to improve this should ensue. When alternatives to conventional HD with low flux membranes are used, such as haemodiafiltration and haemofiltration, more stringent limits in respect of bacterial contamination are mandatory. For such alternative applications microbial count should not exceed 0 Colony Forming Units (CFU)/ml and endotoxin level should be less than .015 IU/ml. **(Good practice)**
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\*See appendix D for details of standards abbreviations used in this chapter.

- ▶ A routine testing procedure for product and feed water should form part of the renal unit policy. Samples should be cultured on Tryptone Glucose Extract Agar or Reasoner's 2A and, for fungi and yeast, on malt extract agar or Sabourad's Dextrose Agar, (all incubations at room temperature, ie 20–22°C). The frequency for testing should not fall below monthly and should be sufficiently frequent to detect trends. **(Good practice)**
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## Dialysate

### Standard

- ▶ The dialysate should contain bicarbonate as the buffer. **(A)**
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## Dialysis membranes

### Standards

- ▶ Patients whose estimated life expectancy is more than seven years and who are unlikely to receive a transplant as a result of human major histocompatibility complex (HLA) sensitisation, high risk of recurrent disease, rare tissue type or other contra-indications (including personal choice), are at high risk of dialysis-related amyloidosis. Such patients, and those with symptoms of dialysis-related amyloidosis should, where possible, receive a dialysis regimen with better clearance of beta 2-microglobulin, and ultrapure dialysate. Such treatments include HD with high flux synthetic membranes and haemodiafiltration. **(B)**
  - ▶ For other patients the balance of evidence favours the use of low flux synthetic and modified cellulose membranes over unmodified cellulose membranes. **(A)**
  - ▶ Those reusing dialysers marked 'for single use only' should have read MDA Device Bulletin DB 2000(04) *Single-use medical devices: implications and consequences of reuse*. **(Good practice)**
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## Dialysis frequency and dose

### Standards

- ▶ HD should take place at least three times per week in nearly all patients. Reduction of dialysis frequency to twice per week because of insufficient dialysis facilities is unacceptable. **(Good practice)**
  - ▶ Every patient receiving thrice weekly HD should show:  
*either* urea reduction ratio (URR) consistently >65%  
*or* equilibrated  $Kt/V$  of >1.2 (calculated from pre- and post-dialysis urea values, duration of dialysis and weight loss during dialysis). **(B)**
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### Recommendations

- ▶ Patients receiving twice weekly dialysis for reasons of geography should receive a higher sessional dose of dialysis, with a total  $Kt/V$  urea (combined residual renal and HD) of >1.8. If this cannot be achieved, then it should be recognised that there is a compromise between the practicalities of dialysis and the patient's long-term health. **(Good practice)**
- ▶ Measurement of the 'dose' or 'adequacy' of HD should be performed monthly in all patients. All dialysis units should collect, and report to the Registry, data on pre- and post-dialysis urea values, duration of dialysis, and weight loss during dialysis. **(Good practice)**

*continued*

- ▶ Post-dialysis blood samples should be collected either by the slow-flow method, the simplified stop-flow method, or the stop-dialysate-flow method (Appendix 2). The method used should remain consistent within renal units and should be reported to the Registry. **(B)**
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### Dialysis-related hypotension

#### *Recommendation*

- ▶ Data on the frequency of dialysis-related hypotension, defined as an acute symptomatic fall in blood pressure during dialysis requiring immediate intervention to prevent syncope, should be collected and reported to the Renal Registry. **(Good practice)**
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### Vascular access

#### *Recommendations*

- ▶ At least 67% of patients presenting within three months of dialysis should start HD with a usable native arteriovenous fistula. **(Good practice)**
  - ▶ At least 80% of prevalent HD patients should be dialysed using a native arteriovenous fistula. **(Good practice)**
  - ▶ No patient already requiring dialysis should wait more than four weeks for fistula construction including those who present late. **(Good practice)**
  - ▶ All dialysis units should collect data on infections related to dialysis catheters and polytetrafluoroethylene (PTFE) grafts to allow internal audit. **(Good practice)**
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## Paediatric section

### The dialysis centre

#### *Standard*

- ▶ All children requiring HD should be treated in a designated paediatric nephrology and dialysis centre. **(Good practice)**
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#### *Recommendations*

- ▶ Children and parents should be free to choose a particular dialysis modality in discussion with the multi-professional team. **(Good practice)**
  - ▶ It is essential that children receiving chronic HD treatment are given a service that meets their physical and psychosocial needs. Children should be nursed in paediatric units where a renally trained children's nurse is always available for advice and support. **(Good practice)**
  - ▶ The child and family should be prepared either in hospital or at home for HD by their named nurse and play specialist using such materials as dolls, videos, story books and games. **(Good practice)**
  - ▶ The child's nutritional status should be managed and monitored by a paediatric renal dietician. **(Good practice)**
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## Vascular access

### Standards

- ▶ Temporary central venous lines risk the loss of potential access points and their use should be kept to a minimum. **(Good practice)**
- ▶ When tunnelled, cuffed central venous catheters are used, the rate of infection should be better than one in every 12 patient months averaged over the total population for three years. **(Good practice)**

### Recommendations

- ▶ The choice of vascular access should take into account the age and size of the child. Although an arteriovenous fistula is regarded as the best long-term vascular access, this may not be possible in small children who can be managed using catheters that are tunnelled subcutaneously. Such catheters can also provide vascular access in older children where early transplantation is anticipated. **(Good practice)**
- ▶ Vascular access should be performed by an appropriately trained surgeon. **(Good practice)**
- ▶ Problems with needle phobia require referral to a child psychologist. **(Good practice)**

## Dialysis frequency and dose

### Standards

- ▶ Standards of adequacy recommended for adult patients should be regarded as the minimum for children. **(Good practice)**
- ▶ Adequacy tests should be performed monthly. **(Good practice)**

## Psychosocial support (for HD and peritoneal dialysis)

### Standard

- ▶ Psychosocial support is an essential part of the care offered to children and families while on dialysis. All members of the multidisciplinary team contribute to such support, but the social worker and psychologist will play lead roles. **(Good practice)**

### Recommendations

- ▶ Each paediatric unit should have a suitably qualified and experienced social worker allocated to the work of the unit and involved in arranging appropriate information and support for each family. In addition, the social worker should assess the economic impact of dialysis on the family and discuss possible sources of financial support. **(Good practice)**
- ▶ Dialysis, particularly in infants, imposes a large burden of care upon families. Strategies such as home-care nursing, respite care and holidays for children need to be considered to prevent family burn-out. **(Good practice)**
- ▶ Children attending the HD unit on a regular basis have the greatest need for educational support as they will miss considerable school time. Liaison between the hospital schoolteacher and the child's school is essential for all hospitalised children. **(Good practice)**

*continued*

► Adolescent patients will require an additional profile of education plans, social issues and careers advice. The timing and practicalities of transition to adult units have to be actively discussed and planned. **(Good practice)**

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## Research and audit

### Recommendation

► Each paediatric renal unit should maintain mortality and morbidity data for patients on HD. All vascular access related problems, such as catheter malfunction, exit site and tunnel infections, septicaemia rates, results of dialysis adequacy parameters and their relationship to growth, should be maintained by each unit. The data should be reported to the British Paediatric Renal Registry to be used for comparative audit and setting of standards. **(Good epidemiological practice)**

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## Access to and withdrawal from dialysis

### Recommendation

► The decisions to institute active non-dialytic management of the patient in ESRD, including nutritional, medical and psychological support; or to discontinue dialysis already in train, should be made jointly by the patient and the responsible consultant nephrologist after consultation with relatives, the family practitioner and members of the caring team, abiding by the principles outlined briefly in chapter 3. The decision, and the reasons for it, must be recorded in the patient's notes. The numbers of patients not taken on to dialysis and the reasons for this decision should be subject to audit, as should the numbers and causes for those in whom dialysis is discontinued. Centres should develop guidelines for palliative care of such patients, including liaison with community services. **(Good practice)**

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## 4 Peritoneal dialysis

## Equipment and fluids\*

### Standards

- A unit offering peritoneal dialysis (PD) should provide not only continuous ambulatory peritoneal dialysis (CAPD) but also automated peritoneal dialysis (APD), in all its forms. It should have access to adequate back-up haemodialysis (HD) facilities and renal transplantation. **(Good practice)**
- All equipment used in the delivery and monitoring of therapies should comply with the relevant standards for medical electrical equipment (BS-EN 50072:1992, BS 5724-2.29:1992, IEC 60601-2-39:1998. Medical electrical equipment. Particular requirements for safety. Specification for peritoneal dialysis equipment). Tubing sets and catheters should carry the CE mark to indicate that the item conforms to the essential requirements of the Medical Devices Directive (93/42/EEC) and that its conformity has been assessed in accordance with the Directive. **(Good practice)**
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\*See Appendix D for details of standards abbreviations used in this chapter.

- ▶ Fluids for PD are required to satisfy the current European quality standards as indicated in the European good manufacturing practice and the European Pharmacopoeia Monograph, *Solutions for peritoneal dialysis*. Manufacturing facilities are required to meet the relevant standards (ISO 9001/2 and EN 46001/2). Product registration files must be submitted to, and product approval given by, the Medicines Control Agency. **(Good practice)**
- ▶ The use of disconnect systems should be standard unless clinically contraindicated. **(A)**

### Recommendations

- ▶ The unit should be aware of the limitations of CAPD and related techniques. **(B)**
- ▶ In selected patients – (those with high small solute transfer rates and little or no residual function) – specialised solutions such as glucose polymers (icodextrin) are preferable to standard solutions. **(B)**
- ▶ Automated peritoneal dialysis (APD) should be available as clinically indicated and not constrained by financial considerations. **(C)**

## Testing membrane function and dialysis adequacy

### Recommendations

- ▶ A peritoneal equilibration test (PET) should be performed after 4–8 weeks on dialysis, and when clinically indicated, eg when biochemical indices or loss of ultrafiltration raise suspicion of changes in peritoneal transport characteristics, or when therapy is changed to APD. **(C)**
- ▶ A total weekly creatinine clearance (dialysis + residual renal function) of greater than 50 l/week/1.73 m<sup>2</sup> and/or a weekly dialysis *Kt/V* urea of greater than 1.7, checked eight weeks after beginning dialysis, are minima. Higher targets are desirable especially for high average and high transporters and APD patients. **(B)**
- ▶ At present both *Kt/V* and creatinine clearance are acceptable measures of adequacy until evidence accumulates to show the superiority of one over the other. Achieving either target is acceptable; creatinine clearance is more difficult to achieve in anuric patients with below average peritoneal solute transport. **(C)**
- ▶ These studies should be repeated at least annually, and more frequently if clinically indicated, particularly if suspicion arises that residual renal function has declined more rapidly than usual. **(C)**
- ▶ Careful attention to fluid balance, especially in anuric patients, is essential. The use of icodextrin in the day-time dwell combined with APD to achieve both adequate solute clearances and fluid removal is recommended. **(B)**

## Infective complications

### Recommendations

- ▶ Peritonitis rates should be <1 episode/18 patient months. **(A)**
- ▶ The negative peritoneal fluid culture rate in patients with clinical peritonitis should be less than 15%. **(B)**
- ▶ The initial cure rate of peritonitis should be more than 80% (without necessitating catheter removal). **(B)**

*continued*

- ▶ Mupirocin should be used as part of routine exit-site care; daily or on alternate days. **(B)**
  - ▶ Nasal application of mupirocin in *Staphylococcus aureus* carriers should be undertaken twice daily for five consecutive days every four weeks. **(A)**
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## Paediatric section

### Equipment, fluids and personnel

#### *Standard*

- ▶ All children requiring PD should be treated in a designated tertiary paediatric nephrology and dialysis centre. **(Good practice)**
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#### *Recommendations*

- ▶ It is essential that the child and family are prepared for PD by a renally trained children's nurse with appropriate written information. Preparation by the nurse and/or play specialist will also include aids such as dolls or videos. **(Good practice)**
  - ▶ Problems with needle phobia will require referral to a child psychologist. **(Good practice)**
  - ▶ Insertion of the chronic peritoneal catheter should be by an appropriately trained surgeon. **(Good practice)**
  - ▶ Training in the management of PD should be supervised by a paediatric renal nurse. **(Good practice)**
  - ▶ The child's nutritional status needs to be managed and monitored by a paediatric renal dietitian. **(Good practice)**
  - ▶ Since the home environment and the impact on the family are so important for the success of PD, psychosocial support such as liaison visits to the home, nursery or school and GP should be provided by the dialysis nurse and other team members such as social workers. **(Good practice)**
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### Testing membrane function and dialysis adequacy

#### *Recommendations*

- ▶ A PET and measurement of adequacy parameters should be undertaken annually but should be considered sooner if there is growth failure. **(Good practice)**
  - ▶ Standards of adequacy recommended for adult patients should be regarded as the minimum for children. **(Good practice)**
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### Infective complications

#### *Standard*

- ▶ A minimum peritonitis rate of <1 episode per 14 patient months is recommended, averaged over three years. **(Good practice)**
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## Research and audit

### *Recommendation*

- ▶ Each paediatric renal unit should maintain mortality and morbidity data for patients on PD. All PD-related problems, such as catheter malfunction rates, exit site and tunnel infections and peritonitis rates, and results of dialysis adequacy parameters and their relationship to growth, should be maintained by each unit. The data should be submitted to the British Paediatric Renal Registry.
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## 5 Haemodialysis and peritoneal dialysis: nutritional and biochemical standards

### Albumin

#### *Recommendation*

- ▶ Serum albumin should be measured regularly. A serum albumin concentration below 35 g/l, using a Bromocresol Green assay, or below 30 g/l using a Bromocresol Purple assay, should prompt clinical reassessment of the patient, looking for fluid overload, malnutrition, underdialysis, and remediable causes of an acute phase response. No audit standards can be set for measurements of serum albumin until there has been progress in standardisation of assays between different laboratories and in the understanding of the causes and appropriate treatment of hypoalbuminaemia in dialysis patients. **(Good practice)**
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### Bicarbonate

#### *Recommendations*

- ▶ Serum bicarbonate, before a haemodialysis (HD) session, measured with minimal delay after venepuncture should be between 20 and 26 mmol/l. **(C)**
  - ▶ For continuous ambulatory peritoneal dialysis (CAPD) patients serum bicarbonate, measured with minimal delay after venepuncture, should be between 25 and 29 mmol/l. **(B)**
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### Parathyroid hormone

#### *Standard*

- ▶ Parathyroid hormone concentrations should be less than 4 times the upper limit of normal of the assay used in patients being managed for chronic renal failure or after transplantation and in patients who have been on HD or PD for longer than three months. **(B)**
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### Phosphate

#### *Standard*

- ▶ Serum phosphate (measured before a dialysis session in HD patients) should be below 1.8 mmol/l. **(B)**
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## Calcium

### Standard

- ▶ Serum calcium, adjusted for albumin concentration, should be between 2.2 and 2.6 mmol/l, in HD (pre-dialysis sample) patients and in PD patients. **(B)**

## Potassium

### Standard

- ▶ Pre-dialysis serum potassium should be between 3.5 and 6.5 mmol/l in HD patients. Serum potassium should be between 3.5 and 5.5 mmol/l in PD patients. **(Good practice)**

## Aluminium

### Recommendation

- ▶ Serum aluminium concentration should be measured every three months in all patients on HD and in all PD patients receiving oral aluminium hydroxide. No patient whose ferritin level is <100 µg/l should have a serum aluminium concentration >60 µg/l (2.2 µmol/l). **(B)**

## Nutritional screening

### Standard

- ▶ All patients with ESRD both before and after the start of dialysis should undergo regular screening for undernutrition. **(Good practice)**

### Recommendations

- ▶ Nutritional screening should include as a minimum subjective global assessment (SGA) measurement of height, weight and serum albumin. Body mass index (BMI) should be calculated (weight in kilograms divided by the square of the height in metres) and unintentional loss of oedema free weight recorded. **(Good practice)**
- ▶ A diagnosis of undernutrition should be considered if any one of the following criteria are met:
  - BMI < 18.5
  - unintentional loss of oedema free weight >10% in past six months
  - albumin < 35 g/l (bromocresol green) or < 30 g/l (bromocresol purple) **(B)**
  - SGA scores of 1–2 (severe undernutrition) or 3–5 (mild to moderate undernutrition). **(Good practice)**

## Assessment of nutritional status in undernourished patients

### Recommendation

- ▶ If a diagnosis of undernutrition is suspected on the above criteria then a full nutritional assessment should be undertaken by a clinician and renal dietitian to elucidate the underlying cause. This should include a full medical history, assessment of dietary intake (three-day dietary record and measurement of the protein equivalent of nitrogen appearance), measurement of CRP, serum bicarbonate and measurement of dialysis adequacy and residual renal function. **(Good practice)**

## Management of malnutrition

### Recommendations

- ▶ In all patients found to have an inadequate dietary intake, identifiable causes should be corrected and dietary advice given to increase intake. Oral supplements, intraperitoneal amino acids (IPAA – CAPD), intradialytic parenteral nutrition (IDPN – HD), nasogastric (NG) feeding, percutaneous endoscopic gastrostomy (PEG) feeding and intravenous partial/total parenteral nutrition are all recognised means by which dietary intake can be supplemented. Local protocols incorporating these methods should be agreed. **(Good practice)**
- ▶ In those patients found to have a persistently high CRP, a source of infection should be sought and treated. **(Good practice)**
- ▶ Where dietary intake is adequate, catabolic factors such as acidosis, thyrotoxicosis and uncontrolled diabetes should be sought and treated. **(Good practice)**

## Dietary sodium intake

### Recommendation

- ▶ All patients with ESRD both before and after the start of dialysis should be advised to limit dietary salt intake to less than 6 g/day (equivalent to approximately 100 mmol of sodium). **(B)**

## Obesity

### Recommendation

- ▶ All patients with chronic renal failure should receive dietary advice to avoid weight gain beyond a BMI >30. **(C)**

## Paediatric section

### Parathyroid hormone (PTH), phosphate and calcium

#### Standard

- ▶ Serum phosphate and calcium should be kept within the normal range. PTH levels should be maintained within twice the upper limit of the normal range but, contrary to adult standards, may be kept within the normal range if growth is normal. **(B)**

### Nutritional management and growth

#### Standards

- ▶ 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 2 years of age and six monthly up to 5 years of age. All measurements should be plotted on reference European growth charts for healthy children. The data should be returned to the UK Renal Registry every six months. **(Good practice)**
- ▶ 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. Inadequate intake should be supplemented orally or enterally. **(Good practice)**

*continued*

► Recombinant human growth hormone (rhGH) may be offered to children of all ages who have a height standard deviation score (Ht SDS) more than 2 SD below the mean (or below the 2nd percentile), and a height velocity SDS less than the 25th centile, whose growth has failed to respond to adequate nutrition, correction of metabolic abnormalities, adequate dialysis and, if post transplant, reduction of prednisolone to a minimum. **(B)**

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#### Sodium intake

##### *Recommendation*

► Many children with CRF have renal dysplasia with renal tubular losses of salt and water that may require salt supplementation. **(C)**

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## 6 Cardiovascular risk factors in patients on dialysis

#### Blood pressure

##### *Standards*

- Pre-haemodialysis systolic blood pressure should be below 140 mmHg. **(C)**
  - Pre-haemodialysis diastolic blood pressure should be below 90 mmHg. **(C)**
  - Post-dialysis systolic blood pressure should be below 130 mmHg. **(C)**
  - Post-dialysis diastolic blood pressure should be below 80 mmHg. **(C)**
  - Post-dialysis blood pressure should be recorded after completion of dialysis, including washback. **(Good practice)**
  - Blood pressure in patients on peritoneal dialysis should be below 130 mmHg systolic and 80 mmHg diastolic. **(C)**
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##### *Recommendation*

► Blood pressure should be measured according to the recommendations of the British Hypertension Society, in the non-fistula arm with an appropriate cuff size, with the patient seated comfortably for five minutes prior to measurement; following 30 minutes abstinence from caffeine and nicotine. The arm should be supported at heart level and at least two measurements of blood pressure are taken, either with a mercury sphygmomanometer or with a validated electronic device. A third should be taken if there is a significant discrepancy between the first two. The mean of the last two measurements should be recorded. **(Good practice)**

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#### Identification and management of cardiac dysfunction

##### *Recommendation*

► All dialysis patients should have unimpeded access to echocardiography for the identification of LVH and LV dysfunction. **(Good practice)**

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**Identification and treatment of left ventricular failure**

**Recommendations**

- ▶ All dialysis units should record the development of left ventricular failure (see explanation in chapter 6.15) in a manner permitting audit of the management of such patients. **(Good practice)**
- ▶ All patients with suspected heart failure should be investigated using echocardiography. **(Good practice)**
- ▶ All patients with proven systolic heart failure should receive treatment with angiotensin converting enzyme (ACE) inhibitors and low-dose beta-blockers unless specifically contraindicated. **(B)**

**Primary prevention of atherosclerotic cardiovascular disease**

**Recommendations**

- ▶ Smoking habit should be recorded in dialysis patients in a manner permitting audit and should be actively discouraged in all those with a reasonable life expectancy and strongly discouraged in those on the transplant waiting list. **(Good practice)**
- ▶ Exercise should be encouraged. **(Good practice)**
- ▶ Glycosated haemoglobin (HbA1c) should be below 7% in dialysis patients with diabetes, measured using an assay method which has been harmonised to the Diabetes Control and Complication Trial (DCCT) standard. **(B)**
- ▶ 3-hydroxy-3 methylglutary–Co-enzyme A (HMG–CoA) reductase inhibitors should be considered for primary prevention in dialysis patients with a 10-year risk of coronary disease, calculated according to the Joint British Societies Chart or the Coronary Risk Calculator, of  $\geq 30\%$ , ignoring the fact that these calculations may not be accurate in patients with renal disease. A total cholesterol of  $< 5$  mmol/l or a 30% reduction from baseline, or a fasting LDL-cholesterol of  $< 3$  mmol/l should be achieved, whichever is the greater reduction. **(C)**
- ▶ HMG-CoA reductase inhibitors should not be withdrawn from patients in whom they were previously indicated and prescribed when such patients start renal replacement therapy (RRT) or change modality. **(C)**
- ▶ Serum or red cell folate should be above the lower limit of the reference range in patients on dialysis. **(Good practice)**

**Secondary prevention of ischaemic heart disease**

**Recommendations**

- ▶ All dialysis units should record myocardial infarction, stroke, transient ischaemic attacks, and symptomatic peripheral vascular disease events in a manner permitting audit of the management of such patients. **(Good practice)**
- ▶ All dialysis patients with a history of myocardial infarction, stroke, peripheral vascular disease, acute coronary syndrome, or who undergo surgical or angiographic coronary revascularisation should be treated with aspirin, an ACE inhibitor, a beta-blocker, and an HMG–CoA reductase inhibitor unless contraindicated. Doses of ACE inhibitors and beta-blockers should be the maximum tolerated. **(C)**
- ▶ In patients in whom lipid-lowering drug treatment is used, total cholesterol should be reduced by 30% or to below 5 mmol/l, or LDL-cholesterol to below 3 mmol/l whichever reduction is the greatest. **(C)**

*continued*

- ▶ Dialysis patients should have unimpeded access to a full range of cardiac investigations including exercise echocardiography, radio-isotopic cardiac scans, and coronary angiography. **(Good practice)**
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## Paediatric section

### Blood pressure

#### Standard

- ▶ Blood pressure varies throughout childhood and should be maintained within two standard deviations of the mean for normal children of the same height and sex. **(C)**
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#### Recommendations

- ▶ The systolic blood pressure during pre-terminal CRF should be maintained at <90th centile for age, gender and height. **(C)**
  - ▶ The systolic blood pressure during PD should be maintained at <90th centile for age, gender and height. Parents should be taught blood pressure recording and provided with appropriate equipment for measurement at home. **(C)**
  - ▶ The systolic blood pressure after HD should be maintained at <90th centile for age, gender and height. In those with sustained hypertension, parents should be taught blood pressure recording and provided with appropriate equipment for measurement on the days between dialyses as this may be more representative of overall control than pre-dialysis blood pressure. **(C)**
  - ▶ 'Whitecoat' hypertension does occur in children and is compounded by the pressure effect of the automated blood pressure devices. Twenty-four hour ambulatory blood pressure monitoring in children should be available in all tertiary paediatric centres. **(Good practice)**
  - ▶ Echocardiography in hypertensive patients is recommended at yearly intervals as a minimum. **(Good practice)**
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### Lipids

#### Recommendations

- ▶ Fasting cholesterol and triglyceride levels should be measured in all children commencing renal replacement therapy and at annual intervals. **(Good practice)**
  - ▶ The dietetic advice from the paediatric renal dietitian for children over two years of age should take into consideration nutritional guidelines on cardiovascular disease and the document *The balance of good health*. **(C)**
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## 7 Anaemia in patients with chronic renal failure

### Standards

- ▶ Target haemoglobin. Patients with chronic renal failure (CRF) should achieve a haemoglobin of 10 g/dl **(A)\*** within six months of being seen by a nephrologist, unless there is a specific reason such as those outlined below. It is unclear as yet how epoetin should be used optimally in patients before dialysis becomes necessary and whether normalisation of haemoglobin gives further benefit.
- ▶ Adequate iron status. Patients must be iron replete to achieve and maintain target haemoglobin whether receiving epoetin or not. **(B)** A definition of adequate iron status is a serum ferritin >100 µg/l and <10% hypochromic red cells (transferrin saturation >20%)\*\*.

### Recommendations

- ▶ Evaluate anaemia in CRF when Hb<12 g/dl (adult males and post-menopausal females), <11 g/dl (pre-menopausal females) **(B)**; anaemia may be considered the result of uraemia if the GFR is <30 ml/min (<45/ml/min in diabetics) and no other cause, eg blood loss, folate or B12 deficiency, is identified. **(B)**
- ▶ Iron administration: oral iron will in general be sufficient to attain and maintain the above targets in those not yet requiring dialysis and those on peritoneal dialysis (PD); in contrast, many haemodialysis (HD) patients will require intravenous iron. **(B)**
- ▶ Regular monitoring of iron status (at least every six months) is essential during treatment to avoid toxicity: a serum ferritin consistently greater than 800 µg/l is suggestive of iron overload. **(B)**
- ▶ Route of epoetin administration: it is preferable to give epoetin subcutaneously even in HD patients. **(A)** Some patients (such as obese subjects) may require intravenous injection to obtain good absorption.
- ▶ Haemoglobin concentration should be monitored monthly for stable hospital haemodialysis patients and 3 to 4 monthly for stable home HD and PD patients and epoetin dosage adjusted accordingly. **(C)** Haemoglobin will require to be monitored more frequently to begin with.
- ▶ 'Resistance' to epoetin: failure to reach the target, or need for doses of epoetin above 300 IU/kg/week, defines inadequate response ('resistance'). Iron deficiency (absolute or functional) remains the commonest cause. Hyporesponsive patients who are iron replete should be screened clinically and by laboratory testing for other common causes, such as raised iPTH, malignancy, infection/inflammation, aluminium toxicity, effect of ACE inhibitors and possibly epoetin antibodies. **(B)**
- ▶ Blood pressure: must be monitored in all patients receiving epoetin and hypertension if present (for definition see Chapter 6) should be treated by volume removal and/or hypotensive drugs. **(B)**

\* Level A evidence so far only for dialysis patients.

\*\* Pre-dialysis blood sample in those on haemodialysis.

## Paediatric section

### Standards

- ▶ Target haemoglobin: all children with CRF and on dialysis should achieve their target haemoglobin within six months of seeing a paediatric nephrologist, unless there is a specific reason otherwise. Targets are age specific, as below:
  - ▶ Children under six months of age should achieve a haemoglobin of greater than or equal to 9.5 g/dl.
  - ▶ Children aged six months to two years should achieve a haemoglobin of greater than or equal to 10.0 g/dl.
  - ▶ Children over two years of age should achieve a haemoglobin of greater than or equal to 10.5 g/dl. **(B)**
- ▶ Adequate iron status: all children should achieve a serum ferritin of greater than 100 µg/l and less than 800 µg/l, whether or not they are receiving epoetin. **(B)**

### Recommendations

- ▶ Evaluation of anaemia: the haemoglobin rises throughout childhood as follows: normal range ( $\pm 2$  SD) before six months of age is 11.5 (9.5–13.5) g/dl; from six months to two years it is 12.0 (10.5–13.5) g/dl; and it rises progressively to 13.5 (11.5–15.5) g/dl by 12 years. Evaluate for anaemia when the haemoglobin falls to <10 g/dl before six months of age, <11 g/dl from six months to two years, and <12 g/dl in older children. **(Good practice)**
- ▶ Iron administration: persistently low ferritin despite oral supplementation is an indication for intravenous iron therapy. Side effects must be monitored. **(B)**
- ▶ Haemoglobin concentration should be monitored every 1–2 months. **(Good practice)**
- ▶ Iron status should be monitored every three months. **(Good practice)**

## 8 Transplantation

### Access to transplantation and allocation of kidneys

### Standards

- ▶ There must be demonstrable equity of access to donor organs irrespective of gender, race or district of residence. Age in itself is not a contraindication to transplantation but age-related morbidity is important. **(Good practice)**
- ▶ All transplant units should have written criteria for acceptance on to the waiting list for renal transplantation and all patients on dialysis should be offered the opportunity of assessment by nephrologists, transplant surgeons and transplant coordinators who should explain whether or not they are suitable for transplantation. The risks associated with transplantation should be fully explained verbally and in writing. **(Good practice)**

- ▶ All dialysis patients should have their suitability for transplantation reviewed at least annually and recorded. Patients should be placed on or removed from transplant waiting lists only after discussion and agreement with nephrologists, transplant surgeons and the patients themselves. **(Good practice)**
- ▶ Kidneys should be allocated according to nationally agreed guidelines that take account of matching, waiting time, sensitisation and other factors. **(Good practice)**

#### Organ donation rate/living donor transplantation

##### *Recommendations*

- ▶ Services for kidney retrieval must be an integral part of organ transplant services and costed into them. **(Good practice)**
- ▶ Purchasers should fund efforts to increase the number of cadaver organs made available by the setting up of transplant co-ordination and organ procurement teams and they should ensure that adequate educational programmes are in place; an important part of this is improved communication with intensive care units. **(Good practice)**
- ▶ An increase in live donor transplantation should be actively encouraged and living donors should remain under life-long follow-up. **(Good practice)**

#### The transplant unit

##### *Recommendations*

- ▶ Transplant units should in general serve at least two million total population, depending on geography, communications and population density. They should be appropriately located and preferably perform at least 50 transplants per year. **(Good practice)**
- ▶ Transplant Units must be adequately staffed both medically and surgically at senior and junior level, and have full support services including a pathologist trained in the interpretation of renal transplant biopsies. Specialist advisory committee recommendations and junior doctors' hours guidelines must be followed. **(Good practice)**
- ▶ The care of the renal transplant recipient is best carried out by a multidisciplinary team with equal input from nephrologists and transplant surgeons. This element of care along with full integration with the dialysis service, is essential. **(Good practice)**

#### Blood pressure

##### *Standard*

- ▶ Blood pressure targets for renal transplant recipients are <130 mmHg systolic and <80 mmHg diastolic. **(B)**

#### Histocompatibility matching and allocation of donor kidneys

##### *Standards*

- ▶ Sensitised recipients must have the HLA-specificities of circulating antibodies defined carefully. The sensitisation status of every patient registered on the national waiting list should be reviewed on at least an annual basis. **(B)**
- ▶ All donor recipient pairs should be cross-matched by an appropriate technique before transplantation. Flow cytometric cross-matching may be helpful for re-transplants and highly sensitised recipients. **(B)**

### Recommendations

- ▶ An accredited tissue typing service is an essential part of a successful kidney transplant programme. Day-to-day direction of the laboratory must be provided by a medical or scientific consultant trained in histocompatibility and immunogenetics (H&I). The tissue typing laboratory staff must be an integral part of the transplant team. Laboratory staff must be available 24 hours a day to type and cross-match against donors. Living donors and recipients must be tested as required under the terms of the Human Organ Transplants Act 1989. **(Good practice)**
- ▶ All centres should document local allocation criteria. Patient registration on the national waiting list must contain sufficient HLA typing and sensitisation information to support the operation of the allocation scheme. **(Good practice)**
- ▶ All screening for HLA-specific antibodies should use a typed panel that allows interpretation of positive reactions. The tissue-typing laboratory must be provided with patients' serum following sensitising events such as the transfusion of blood products or transplantation. Following transplantation it is essential that the tissue-typing laboratory continues regularly to receive serum samples for antibody screening. Failure to provide these samples may jeopardise a patient's future chances of transplantation. All potential recipients must be screened regularly for HLA-specific antibodies. This should be at least every three months. **(Good practice)**

### Immuno-suppressive regimens and early complications

#### Standard

- ▶ Transplant units should provide written documentation on agreed policies regarding immunosuppressive protocols, prophylaxis against cytomegalovirus, pneumocystis and renal vein thrombosis and management of delayed graft function. Such protocols should be reviewed annually in the light of published research and in-house experience. **(Good practice)**

### Clinical outcome and audit

#### Standards

- ▶ Organs should be retrieved from at least 15 heart beating donors per million population per year. Each unit should transplant at least 25 patients per million population per year using cadaver kidneys. Efforts should be made to limit the cold ischaemic time to less than 30 hours in all cases and to much less than 24 hours wherever possible. Each transplant unit which has appropriate resources to perform live donor transplantation should transplant a minimum of five living donor grafts per million population per year, but it is hoped that a higher number than this can be achieved in the future. At least 60% of recipients of cadaveric grafts should receive a 000 mismatch or other favourable matched kidney. **(Good practice)**
- ▶ At least 70% of heart beating cadaver kidney transplants should function immediately, and at least 95% should function eventually. Graft survival of second grafts should be the same as for first grafts, provided that adequate analysis of alloantibodies and fluorescence activated cell sorter (FACS) cross-matching are used. There should be at least 95% patient survival at 1 year after transplantation for recipients of live donor and cadaveric kidneys. More than 84% of cadaver grafts and 90% of live grafts should still be working at 1 year and at least 68% of cadaver grafts and 73% of live donor grafts should still be working at five years. **(Good practice)**

## Paediatric section

### Access to transplantation and allocation of kidneys

#### Standards

- ▶ All children under 15 years of age being prepared for or undergoing transplantation should be cared for in a paediatric nephrology centre. **(Good practice)**
- ▶ The UKT scheme giving priority to children for favourably matched kidneys should continue. **(Good practice)**

#### Recommendations

- ▶ Pre-emptive transplantation should be encouraged as it conserves peritoneal and vascular access for future use and improves growth. **(Good practice)**
- ▶ Living related donor transplantation should be encouraged. **(Good practice)**

### Organ donation/living donor transplantation

#### Recommendation

- ▶ The use of kidneys from donors under the age of five years or over 55 years is not recommended in paediatric patients. **(B)**

### The transplant unit

#### Recommendation

- ▶ There should be 24-hour access to a consultant paediatric nephrologist, transplant surgeon, urologist, general surgeon, anaesthetist and intensivist. **(Good practice)**

### Histocompatibility matching and allocation of donor kidneys

#### Recommendation

- ▶ Centres should aim for at least 60% of kidneys being favourably matched. **(B)**

### Immuno-suppressive regimens and early complications

#### Recommendation

- ▶ Centres should be encouraged to enter patients into prospective randomised paediatric trials to assess the efficacy, safety and tolerability of new immunosuppressive agents. **(Good practice)**

### Transfer of patients to adult service

#### Recommendation

- ▶ All centres should have a written policy for the transfer of adolescents to adult units. **(Good practice)**

**Clinical outcome and audit**

**Standards**

- ▶ Each unit should report their data to the Paediatric Renal Registry to enable annual national assessment of outcomes of paediatric transplantation. **(Good epidemiological practice)**
- ▶ Centres should audit each graft loss to identify possible avoidable factors. **(Good practice)**

## 9 Blood-borne viruses and microbiology in the renal unit

**Good working practices**

**Recommendation**

- ▶ The general and universal precautions described below should be observed. **(Good practice)**

**Immunisation and patient testing**

**Recommendations**

- ▶ Patients awaiting start of ESRD treatment should be immunised against HBV as soon as possible while their plasma creatinine remains relatively low. **(B)**
- ▶ All long-term dialysis patients should be immunised against HBV. Those who develop an adequate antibody response should be given a booster dose of vaccine every five years. As there is evidence that poor responders derive some benefit from vaccination, they should be given a booster after one year and every five years thereafter. Non-responders should receive a repeat course of vaccine. **(B)**
- ▶ Testing should be carried out three monthly for HBsAg, and HCV antibody and annually for HIV antibody. An annual test for HBs Ag is sufficient for patients who have demonstrated immunity. More frequent testing is appropriate in those exposed to blood-borne viruses (BBVs). **(Good practice)**
- ▶ Hepatitis B immunoglobulin and vaccine should be given, if appropriate, to susceptible patients who have been exposed to the virus. **(B)**
- ▶ The patient's informed consent to testing should be obtained. Those who withhold consent or who are incapable of giving consent should be managed as though they were BBV infected. However, infected patients should not be denied dialysis. **(Good practice)**

**Management of patients carrying BBVs**

**Recommendations**

- ▶ Whenever possible, staff should care for only BBV-infected or uninfected patients during one shift. If this is not practicable, the more experienced staff should be assigned the task of caring for a mixed group of patients. Designated staff should nurse affected patients when there has been an outbreak of BBV infection in a unit. In the case of hepatitis B, staff who demonstrated immunity should care for the patients whenever possible. **(Good practice)**
- ▶ Carriers of hepatitis B should be dialysed in separate rooms on dedicated machines. **(Good practice)**

- ▶ Carriers of hepatitis C should be dialysed in separate shifts and units should move towards providing separate rooms for such patients. **(Good practice)**
  - ▶ Dialysis machines used for patients positive for hepatitis C may be used for other patients provided that the dialysis circuit has been adequately decontaminated and the external surface cleaned with some suitable disinfectant between patient use. **(Good practice)**
  - ▶ Segregation of HIV-infected patients should be considered, based on local risk assessment. Their machines should be treated as for patients with Hepatitis C. **(Good practice)**
- 

## Dialysis personnel and BBVs

### Standards

- ▶ Staff working in dialysis units in contact with patients, machines or materials used in dialysis should show immunity to HBV. Non-, or poor responders should be tested annually for HBs antigen and antibody to HB core antigen. Staff who are positive for HBsAg should demonstrate they are not HBe antigen positive or are HBe antigen negative with a viral load of less than  $10^3$  genome equivalents per ml. Non-clinical staff need not be tested for BBVs. **(Good practice)**
  - ▶ There is no need to screen for HCV or HIV in staff, but those known to be at risk of acquiring infection or known to be infected should be encouraged to seek advice from an occupational health physician. **(Good practice)**
- 

## *Staphylococcus aureus* (SA) infection control in dialysis units

### Recommendations

- ▶ All units should have a documented infection control policy covering general measures together with specific advice on limiting SA-related infections and preventing the spread of MRSA and other multi-resistant strains. This will usually be developed in conjunction with the hospital infection control unit. Key features should include guidelines for screening to detect nasal carriage, prophylactic therapy in different dialysis populations, antibiotic therapy for presumed *staphylococcal* infections, staff and patient education, an emphasis on the importance of hand washing and an isolation policy for MRSA carriers admitted to hospital. **(Good practice)**
  - ▶ All dialysis patients should be screened on a three-monthly basis for SA nasal carriage. **(Good practice)**
  - ▶ Patients undergoing haemodialysis via a temporary central venous dialysis catheter should have either 2% mupirocin ointment **(A)** or povidone-iodine ointment **(A)** applied to the cannula exit site after insertion and at the end of each dialysis session.
  - ▶ All HD patients who are SA nasal carriers should receive either eradication therapy with a course of intranasal 2% mupirocin cream **(Good practice)** or eradication therapy followed by long-term once-weekly application of 2% mupirocin cream. **(A)**
  - ▶ Patients on peritoneal dialysis should apply 2% mupirocin ointment to the exit site on a daily or alternate daily basis as part of routine exit-site care. **(B)**
  - ▶ Patients on PD who are SA nasal carriers should receive either eradication therapy with a course of intranasal 2% mupirocin cream **(Good practice)** or have regular five-day courses of intranasal 2% mupirocin every four weeks. **(A)**
-

# 10 The management of patients approaching end-stage renal disease (ESRD)

## Recommendation

- ▶ Patients with progressive renal failure should be managed in a clinic with multidisciplinary support from dietitians and specialist nurses. **(Good practice)**

## Blood pressure control

### Standards

- ▶ Blood pressure targets are 125/75 mmHg for those with progressive proteinuric renal disease and 130/80 mmHg for those with stable renal function. **(A)**
- ▶ Angiotensin converting enzyme (ACE) inhibitors should be considered as the agents of first choice in the management of hypertension in patients with progressive renal disease. **(A)**

### Recommendations

- ▶ Patients should be advised where necessary to stop smoking. **(B)**
- ▶ Patients should be advised where necessary to reduce dietary salt intake, take regular exercise, and reduce alcohol intake. **(C)**

## Nutritional management

### Recommendations

- ▶ Patients should be advised where necessary to lose weight, reduce dietary salt intake, and take regular exercise. **(Good practice)**
- ▶ Dietary protein intake should be approximately 0.75 g/kg/day. **(B)**
- ▶ Patients should be regularly screened for undernutrition. **(Good practice)**
- ▶ Serum bicarbonate should be in the normal range. **(C)**
- ▶ Serum phosphate should be <1.9 mmol/l. **(B)**

## Initiation of dialysis

### Recommendations

- ▶ Dialysis should be considered when the weekly urea clearance falls below the equivalent of a  $Kt/V$  of 2.0 (equivalent to a GFR of approximately 14 ml/min). Dialysis will be indicated in such patients if there is evidence of malnutrition or if symptoms interfere with quality of life. It is prudent to consider dialysis at this early stage in those with predictably steadily progressive renal failure as occurs in polycystic disease or glomerulonephritis. Those with relatively stable renal function, however, may often be treated conservatively. **(Good practice)**
- ▶ All patients should be able to start dialysis when clinically indicated; there should be no waiting list for dialysis. **(Good practice)**
- ▶ Patients with progressive renal failure should be referred to a nephrologist early in the

course of their disease (serum creatinine 150–200 µmol/l) to enable dialysis to be started in a planned fashion. **(Good practice)**

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## Paediatric section

### Indications for initiation of dialysis

#### Standards

- ▶ All children should be offered dialysis if their measured or calculated GFR falls to 10–15 ml/min/1.73m<sup>2</sup> unless the child remains asymptomatic and growth is well maintained. **(Good practice)**
  - ▶ Pre-emptive transplantation should be offered to children in whom the progressive decline in renal function gives sufficient time to prepare them for the transplant list, as transplantation is the goal for all children with ESRD. **(Good practice)**
- 

#### Recommendation

- ▶ Paediatric renal units should supply data to the Paediatric Renal Registry, including the time of referral to the paediatric renal unit with growth parameters at that time. Similar indices should be recorded at the time of initiation of dialysis or pre-emptive transplantation. This will provide data for informed discussion about ways of improving late referral and timing of renal replacement therapy (RRT) intervention. **(Good epidemiological practice)**
- 

#### Standards

- ▶ All children should complete a standard course of childhood immunisation as stipulated by the Department of Health. **(C)**
  - ▶ Each unit should have an immunisation policy. It is recommended that hepatitis B, varicella and BCG vaccination after Heaf testing are completed prior to transplantation. **(Good practice)**
- 

### Nursing and family support

#### Standards

- ▶ All children should be cared for by paediatric nephrology nurses, who deliver specialised care for children who need RRT both in hospital and in the community. **(Good practice)**
  - ▶ Prior to commencing home peritoneal dialysis, a home assessment should be undertaken. **(Good practice)**
  - ▶ All families should have access to other staff who may be involved in the care of the child with chronic renal failure, including play staff, schoolteachers, psychologists, psychiatrists and youth workers. **(Good practice)**
-

### Recommendation

- ▶ All children and families should have access to support from members of the multidisciplinary team. Their information needs should be assessed and met via interviews, booklets, videos and other resources. It is important that phobias, particularly needle phobias, are addressed as these can assume immense importance in the long-term care of a child on RRT. **(Good practice)**
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## 11 Acute renal failure

Where patients should be managed?

### Recommendations

- ▶ Renal wards admitting patients with acute renal failure (ARF) require either a designated High Dependency Unit (HDU) or access to a centralised HDU where, in addition to renal replacement therapy (RRT), the following are available: close nursing supervision, oxygen, continuous electrocardiogram (ECG) and oxygen saturation monitoring, automated blood pressure (BP) monitoring, and central venous pressure (CVP) monitoring facilities and expertise. There should be provision for dialysis on alternate days for all patients with ARF and for daily dialysis for those who require it. **(Good practice)**
  - ▶ Patients with multiple organ failure and those who are haemodynamically very unstable should be managed on an intensive care unit (ICU), and be transferred there in a timely manner. **(Good practice)**
  - ▶ Whilst it is reasonable for patients with uncomplicated ARF to receive dialysis on a chronic dialysis unit, it is bad practice for this to be done without adequate on-site medical supervision. **(Good practice)**
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Techniques of treatment and when to start

### Recommendation

- ▶ Treatment of haemodynamically unstable patients with ARF requires continuous treatment techniques and the facilities of an ICU. **(Good practice)**
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Access to specialist nephrological services

### Recommendations

- ▶ In hospitals with both a renal unit and an ICU, patients with multiple organ failure including ARF should be managed jointly by intensive care physicians and nephrologists. **(Good practice)**
  - ▶ All those supervising RRT should have received adequate training. **(Good practice)**
  - ▶ All ICUs without in-house access to a renal unit should have formal links with a named renal unit for advice and consultation, which should be sought for all appropriate patients. This commitment has workload and staffing implications for renal units. **(Good practice)**
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## Paediatric section

### *Recommendations*

- ▶ All children with ARF require discussion with a paediatric nephrologist. Early transfer for investigation and management is essential in those with rapidly deteriorating renal function or in those with haemodynamic or biochemical disturbances. Children with ARF and multi-organ failure require transfer to a designated regional paediatric ICU lead centre. Although most children with ARF recover renal function, nephrological follow-up during childhood is often necessary as the long-term prognosis is uncertain. **(Good practice)**
  - ▶ Where children with ARF are provided with dialysis by adult nephrologists for reasons of geography, the child should be primarily under the care of a paediatrician, who will consult when necessary with the regional paediatric unit and discuss complications at an early stage. Transfer to a regional unit is indicated if there is progression to multi-system disease or if it is evident that the child has reached end-stage renal failure. **(Good practice)**
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