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Over the last few decades, the prevalence of chronic renal impairment has increased throughout the population, especially in the older age group.[1] This is not just a consequence of the general increase in longevity, but is also caused by a higher incidence related to improved survival of patients with chronic diseases affecting renal function, such as diabetes, hypertension and ischaemic heart disease, and improved survival of patients with established renal failure.[2–4]

Dialysis and transplantation have greatly improved survival and quality of life in patients with severe chronic renal failure. While such treatments were restricted in the past to younger patients, there is no age limit for dialysis in current national and international guidelines.[5,6] However, many older people with renal impairment have significant co-morbidities or are too frail to be considered for dialysis or transplantation and may therefore not be referred to a nephrologist.[7] Conservative management can improve most symptoms of renal failure, and progression of renal impairment may be halted or slowed down with appropriate treatment. The aim of this review is to discuss non-dialysis management of chronic renal insufficiency, with particular emphasis on quality of life and the management of symptoms.

I will start by summarizing normal age-related changes in renal structure and function and then define renal failure. I will next outline indications for referral to a nephrologist, discuss measures to slow deterioration of renal function, and finally concentrate on how to manage symptoms and complications of renal impairment.

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The normal aging kidney

Age-induced histological changes are often difficult to distinguish from disease-associated changes. A major histological feature of aging in the kidney is sclerosis, and this affects mainly the larger renal vessels, leading to a reduction of cortical blood flow. The number of glomeruli decreases with age due to nephrosclerosis. Other features include tubular dilatation, predominantly affecting the distal nephron, and an increase in connective tissue.[8–10]

One of the main functional changes in the aging kidney is impairment of sodium conservation, leading to salt and water loss.[11] Salt wasting is enhanced by low plasma renin and aldosterone levels, as both progressively decrease with each decade of life.[12] This is further compounded by a reduction in responsiveness of the renin-angiotensin-aldosterone axis to volume depletion,[13] and a decrease in concentration ability due to diminished medullary tonicity. These physiological changes render older individuals susceptible to hyponatraemia and volume depletion. Potassium balance is also impaired, leading to a decrease in total body potassium content, even at normal serum potassium concentrations.[14] While the acid-base status is similar to the young under normal conditions, recovery of the acid base balance after an acid load may be delayed in older people.[15]

Renal failure

As in younger people, the glomerular filtration rate (GFR) is the most reliable indicator for renal function. It is a strong predictor of residual renal function and of complications associated with renal failure.[5,16,17] The GFR is measured indirectly

The Cockroft-Gault Formula

Creatinine clearance (ml/min/1.73 m^2) = (140–age) × weight (kg) × CF/Serum Creatinine (μmol/l)
CF = correcting factor; female 1.04; male 1.23

by inulin clearance. This test is cumbersome and clinicians tend to use the 24-hour creatinine clearance as an approximation of GFR.[18] However, the creatinine clearance may overestimate GFR by about 15%.[18] When results of a creatinine clearance are not available, the GFR can be estimated using a prediction formula (the Cockroft-Gault formula, see box above) that takes into account serum creatinine concentration, age, gender and body size. The serum creatinine level alone is a poor predictor of renal function, since it is affected by age, sex, body weight, muscle mass, renal tubular handling of creatinine, diet and drugs.

The discrepancy between a 'normal' serum creatinine and renal function can be illustrated by the examples below using the Cockroft-Gault formula to calculate creatinine clearance. A 45-year-old male weighing 80 kg with a serum creatinine of 100μ °mol/l has a creatinine clearance within the normal range (93 ml/min), but a 50 kg 80-year old female has a significantly reduced creatinine clearance (31 ml/min), indicating significant renal impairment at the same serum creatinine level.

The normal range of GFR is 90 to 120 ml/min. There is no difference in reference GFR values for males and females.[18] Chronic renal failure is defined as a GFR of less than 60 ml/min for three months or more. The National Kidney Foundation defines five stages of renal dysfunction. (Table 1).[19]

Renal function is reduced when the GFR falls to 75% of normal. At this early stage of renal impairment, the acid-base, electrolyte and phosphorous balance is maintained but mild anaemia may occur. Further progression of renal dysfunction leads to acidosis and proteinuria. Severe renal insufficiency is defined as a GFR below 30ml/min. At this stage, clinical problems occur including uraemia, anaemia, hyperkalaemia, hyperphosphataemia, renal osteodystrophy, worsening acidosis and hypocalcaemia. In patients where dialysis is appropriate, renal replacement therapy is recommended once the GFR falls below 10 ml/min, but a definite indication for the start of renal replacement therapy is when GFR is < 6 ml/min[5,6] ;diabetic patients often suffer from uraemic symptoms when GFR is >10 ml/min, and dialysis may be considered at an earlier stage.

The main cause of chronic renal insufficiency in older people is nephrosclerosis (41%), followed by diabetes (22%), tubulo-interstitial disease

Table 1. *Stages of renal dysfunction*

Stage	Description	GFR (ml/min/1.73m^2)	Metabolic consequences
1	Normal	120–90	
2	Early renal insufficiency	89–60	Increase in parathormone Mild anaemia may occur
3	Moderate renal insufficiency (chronic renal failure)	59–30	Decrease in calcium absorption, anaemia almost invariable, left ventricular hypertrophy malnutrition, fall in lipoprotein activity
4	Severe renal failure (pre-end stage renal disease)	29–15	Rise in triglyceride concentration Hyperphosphataemia metabolic acidosis Tendency to hyperkalaemia
5	End stage renal disease (uraemia)	<15	Azotaemia develops

Summarized from the National Kidney Foundation – K/DOQI classification19

(14%), obstructive uropathy (11%), glomerular disease (11%) and polycystic kidney disease (2.0%).[12] Irrespective of the initial insult, renal disease progresses by common pathway mechanisms, once GFR falls to 75% of normal. Therefore early detection is important to prevent further injury and progressive decline in function. Management of established chronic renal impairment can be divided into measures which retard progression and treatment of complications.

Referral for a specialist renal opinion

The most common causes of acute renal failure are nephrotoxic drugs and volume depletion.[20, 21] In patients with mild chronic renal impairment, a deterioration of renal function may be precipitated by the same factors, and discontinuation of the offending agents and/or rehydration may halt or reverse deterioration. Prompt decision-making will ensure preservation of renal function and thereby avoid dialysis. Referral to a nephrologist should be considered early, irrespective of age (see Table 2 for indications for nephrology referral). The National Institute of Health consensus (NIH) recommends nephrology referral at a serum creatinine >135 μmol/l in women and 180 μmol/l in men.[22] The British Renal Association's recommendation for referral uses a slightly lower serum creatinine (males >150 μmol/l, females >120 μmol/l).[6] Both guideline recommendations equate to a mandatory referral at a GFR of 30 ml/ml. There are no specific guidelines for referral of the older population. The North Thames Dialysis study of clinical outcomes, quality of life and costs in patients over the age of 70 years suggests that dialysis extended life at cost levels comparable to other life-extending measures, and that patients on dialysis had similar quality of life to age-matched individuals not on dialysis.[23] Severity of co-morbid conditions and functional capacity are more important than age in predicting survival and morbidity of patients on dialysis.[24] Late referral affects survival adversely.[24] Even where dialysis is not deemed appropriate, it may be possible to halt progression of renal failure, and joint management often benefits the patient.

It is important to realize that patients who are unfit for long-term dialysis may benefit from short-term dialysis when in acute renal failure, and that patients who would not be suited to any form of dialysis might still benefit from conservative measures to alleviate symptoms and retard disease progression.

Measures to retard progression of renal impairment

There are a number of options to retard progression of renal impairment. These include control of systemic hypertension, control of blood glucose in diabetes, dietary restriction, treatment of hyperphosphataemia and treatment of hyperlipidaemia. Most of the data upon which the recommendations for delaying disease progression are based come from trials in younger populations and from individuals without severe frailty and multiple significant co-morbidities. There are no specific studies on the population targeted in this review. The potential future benefits of such preventative treatments has to be weighed against side-effects and effects on the quality of life in this

Table 2. *Renal Association recommendation for referral to a nephrologist*[6]

- Acute renal failure
- Acute glomerulonephritis
- Nephrotic syndrome
- Unexpected rise of serum creatinine by 50 μmol/day
- Raised plasma creatinine (>150 μmol/l) level, without apparent cause, with/or without clinical complaints
- Abnormalities on urine analysis (proteinuria, haematuria) without apparent cause, with or without clinical complaint
- Diabetic patients with normal or mild renal impairment with proteinuria >3g/d
- Diabetic patients with moderately impaired renal function (CCT 59–30 ml/min) and proteinuria
- Refractory hypertension associated with abnormal urine analysis and/or elevated plasma creatinine concentration
- Macroscopic haematuria age >45 years. Urologist referral first line

group of frail older patients, and such treatment should only be recommended when real clinical benefits are likely during the expected lifespan of the patient.

Control of hypertension

Control of hypertension is the most important preventative measure in this group. With careful selection of agents, it can be achieved with minimal side-effects. Raised systolic blood pressure is an important risk factor for end-stage renal disease, and blood pressure control has been established as a major modality to ameliorate progressive renal injury in several controlled trials.[25,26] Optimal blood pressure control can thus prevent or postpone the need for renal replacement therapy.[25] Control of hypertension will also decrease the risk of stroke which causes significant morbidity and mortality in this population.

There is a plethora of anti-hypertensive drugs to choose from and possible contraindications have to be weighed against the benefits. The WHO/ISH Hypertension Guidelines provide aid in choosing the most appropriate drug regime.[27] Sustained inhibition of the renin-angiotensin-aldosterone axis appears to offer an advantage over other antihypertensive regimes at similar levels of blood pressure reduction, by reducing intra-glomerular pressure.[28,29] In patients with a serum creatinine of >124 µmol/l, there is a close relationship between ACE inhibitor therapy and long-term preservation of renal function, even in patients who had an initial increase in creatinine of up to 30% after starting the ACE inhibitor. Withdrawal of the ACE inhibitor should therefore only be considered when the rise in serum creatinine above baseline exceeds 30% within the first two months of treatment, or if hyperkalaemia develops (serum potassium > 5.6 mmol/l).[30] In deciding the appropriate therapeutic dose, it has to be borne in mind that age-dependent changes in kidney function, over and above disease-related deterioration of renal function, have pharmacological implications. The dosage of loop diuretics needs to be adjusted to renal function, as their action depends on their active secretion in the proximal tubules. With declining renal function, higher dosages are required. Thiazide diuretics given alone are ineffective when the GFR is (30 ml/min, except for metolazone.[31] However, co-administration of thiazide diuretics and loop diuretics may potentiate the natriuretic effect in advanced renal insufficiency.[32]

Blood glucose control

Insulin resistance is a well-recognized feature of chronic renal failure.[33] Patients whose diabetes was previously controlled with diet may require anti-hyperglycaemic medication to achieve good control once renal impairment has developed. Strict control of blood glucose delays progression of renal disease. The diabetes control and complications trial (DCCT) and the UK Prospective Diabetic Study (UKPDS) have demonstrated that good blood glucose control reduces the risk of microalbuminuria in normo-albuminuric patients.[34,35] Both studies have, however, included younger individuals with a low level of co-morbidity.

Protein restriction

Protein restriction improves uraemic symptoms and slows progression of renal disease.[36,37] The Modification of Diet in Renal Disease (MDRD) study showed that moderate protein restriction (protein intake of 0.6 g/kg/day, compared with an intake of 1.3 g/kg/day in the control group) in individuals with a baseline creatinine of ≥ 176 µmol/l (2.0 mg/dl) reduces the mean decline in GFR within four months from 3.9ml/min to 2.8 ml/min.[36] Protein restriction should be considered once the GFR falls below 25 ml/min. However, malnutrition is common in patients with renal failure, due both to poor oral intake and also to a catabolic metabolic state. Even without a prescribed diet, patients self-restrict their intake because they feel bloated and because of reduced or altered taste sensation.[38,39]

Whilst diet is a very important aspect of the management of patients with chronic renal failure, and cheap for the doctor to prescribe, it can make the patient's life difficult. Older patients often find it hard to get used to a new diet. Once sugar, salt, protein and fats are restricted, there is little to make the food tasty and attractive. Most ready-made foods available for purchase would be considered unsuitable, and preparing food for a special diet is therefore left either to the patient or the carer. This is likely to be expensive and work-intensive. Malnutrition is a real danger in this situation, and any potential benefits may thus

be outweighed by burdens.

In patients where dialysis is not considered, and the main treatment goal is enhancing quality of life, a strict low sodium, low potassium, low protein diet, may thus not be indicated. Emphasis on good nutrition, dietary supplements, and advice on how to overcome the adverse effects of an altered taste sensation is more likely to have beneficial effects in this patient group. Zinc deficiency can be the cause of persistent metallic taste and symptoms improve with supplementation.[39]

Hyperphosphataemia

Phosphate retention begins early in renal disease and is related to the development of hyperparathyroidism. Hyperphosphataemia has no direct symptoms but has adverse effects on renal bone disease and may lead to soft tissue calcification. Phosphate restriction has been shown to slow down progression in mild and advanced renal impairment.[40] The need for treatment depends on the general prognosis of the patient. Where management is mainly palliative, no treatment may be required.

Hyperlipidaemia

Irrespective of lipid levels, patients with chronic renal failure have a high risk of developing cardiovascular disease. Cardiac death is four to 20 times higher than in the general population. Recommended target concentrations for LDL-cholesterol (LDL-C) are slightly higher in the Second Joint Force of European Societies on coronary prevention than in the US National Cholesterol Education Program (NCEP) ($\leq$ 3mmol vs. $\leq$ 2.6 mmol).[41,42] Statins (HMG CoA reductase inhibitors) are agents of first choice, but dose-adjustment is necessary if GFR is $\leq$ 30ml/min. Fibrates may be used to treat hypertriglyeridaemia. In a recent study, gemfibrozil reduced the cardiovascular mortality by lowering triglycerides and raised HDL-cholesterol without affecting the LDL-cholesterol levels.[43] The recommended dose is 300-600 mg/d. A GFR of less than 15 ml/min is a relative contraindication. Combination therapy (statin plus gemfribrozil) is not recommended because of the increased risk of rhabdomyolysis.

Management of complications of chronic renal failure

The complications of chronic renal failure include fluid overload, electrolyte imbalance, metabolic acidosis, anaemia, and renal osteodystrophy. Symptoms of renal failure may be non-specific. Tiredness, lethargy, dyspnoea, pruritus, insomnia, weakness and deterioration in mobility are common and have significant impact on the quality of life.

Fluid overload

Fluid overload results in oedema and dyspnoea. It is managed by a combination of salt and fluid restriction, diuretics and, in patients fit for invasive treatments, dialysis. A high dietary salt intake will enhance fluid retention in the failing kidney, leading to oedema. Moderate dietary salt restriction with mild fluid restriction can achieve an adequate fluid balance without being a burden. When prescribing diuretic treatment, it is important to realize that the maximal effective dose of diuretics is higher in patients with chronic renal failure owing to decreased renal perfusion, diminished proximal secretion (due to the retention of competing anions) and enhanced activity of sodium-retaining forces. In moderate renal failure, 80 mg of frusemide or 2–3 mg of bumetanide will achieve maximal diuresis, whereas 200 mg of frusemide or higher, or the equivalent dose of bumetanide (8–10 mg) is needed in severe chronic renal insufficiency to achieve a similar effect.[31,32,44] Often a combination of a thiazide and a loop diuretic will achieve good diuresis at lower dosage of both components.[31]

Hyperkalaemia

Hyperkalaemia is usually not apparent until the GFR falls below 10 ml/min as the failing kidney is able to excrete more potassium per nephron, resulting in normal absolute potassium excretion despite reduced GFR.[45] With falling GFR, colonic adaptation leads to enhanced extra renal potassium loss. In chronic renal failure, the most common cause of hyperkalaemia is potassium-retaining drugs. Other common causes are infection, massive gastrointestinal bleeding and haemolysis. The management of hyperkalaemia in the older patient with renal failure is no different from that of younger individuals. Serum

potassium should be kept below 5.4 mmol/l, if possible, since above this level the risk of cardiac arrhythmias is high. The first measure is discontinuation of drugs favouring hyperkalaemia (e.g. potassium-sparing diuretics, ACE-inhibitors) and treatment of dehydration, if present. Correction of acid-base disturbances will also alleviate hyperkalaemia. If this does not suffice, dietary potassium restriction is recommended (see Table 3 for food items high in potassium).

The involvement of an experienced dietician helps patients to match the needs of the diet with their taste preferences and resources and makes coping with the diet easier.

Acidosis

The ability of the kidney to reclaim and generate bicarbonate mainly from the proximal tubule decreases with increasing renal impairment. When the GFR is below 25 ml/min, metabolic acidosis is likely to occur. With further decline in renal function, an increased anion-gap and metabolic acidosis develop, because of the retention of hydrogen ions bound to unmeasured anions, such as sulphate and phosphate. With progression of renal impairment, there is progressive acid retention. Unexcreted hydrogen ions are buffered by the carbonates and phosphates in bone, leading to dissolution of bone minerals contributing to renal bone disease.[47]

Acidosis leads to compensatory hyperventilation and a subjective feeling of dyspnoea. It is associated with catabolic metabolic changes leading to malnutrition and muscle wasting.[48] There is evidence that treatment with sodium bicarbonate improves nitrogen balance.[49] Correction of acidosis may also improve insulin sensitivity in patients with renal impairment and insulin resistance.[50]

Treatment with sodium bicarbonate 1–2 mEq/kg/day should be started if the serum bicarbonate falls below 20 mmol/l. Sodium retention is a dose-limiting side effect, and can lead to volume overload, hypertension and heart failure. Hence careful titration has to be undertaken and diuretic dosage adjusted accordingly. There is a slight risk of metabolic alkalosis with excessive use of sodium bicarbonate, but this is unlikely to occur at the usual therapeutic dosage.

Anaemia

Normochromic normocytic anaemia is common in patients with renal impairment. It can be seen

Table 3. *Food of high potassium content*

Food high in potassium	Suitable alternatives
Bananas, oranges, grapes, melon, mangoes, apricots, pure fruit juices (including tomato juice), dried fruit e.g. raisins, sultanas, prunes, dates, figs	Apples, pears, peaches, pineapple, clementines, grapefruit, mandarins, tangerines
All Bran, Bran Flakes, Muesli and any cereals containing fruit or nuts	Puffed wheat, sugar puffs, Weetabix, Shredded Wheat, porridge, frosted wheat
Baked beans, beetroot, mushrooms, spinach, yam, avocado, tomatoes	Runner beans, cabbage, carrots, peas, onions, swede, turnip
Coffee, chocolate (bars and drinks) Evaporated and condensed milk, Horlicks, Ovaltine, Complan, Ribena, High juice squashes, beer, lager, stout, cider	Tea, lemonade, orange squash (not high juice), spirits, white wine
Peanut butter, all varieties of nuts, potato snacks e.g. crisps, fudge	Corn or wheat snacks, boiled sweets, marshmallows, Turkish delight
Salt substitutes e.g. Lo Salt, Ruthmol	Pepper, vinegar, herbs, spices
Minimize potato consumption	Rice, pasta

Evaluated using Mcane & Widdowson's Composition of foods[46]

even in mild renal impairment (GFR 70% of normal).[51] Therapy with erythropoietin has been shown to increase daytime alertness and quality of sleep[52] and to improve general wellbeing,[53] nutritional status and cardiac output.[54] Regression of left ventricular hypertrophy has also been observed.[54] Furthermore, reversal of anaemia has been reported to retard progression of renal impairment.[55,56] While most of these studies relate to younger patients with renal failure, there is no reason to suspect that similar treatment effects would not occur in older persons.

Baseline investigations for anaemia should be performed if the haemoglobin (Hb) concentration is <12 g/dl (haematocrit <37%) in adult males and post-menopausal females.[57,58] Anaemia associated with renal impairment is multifactorial, thus the first line of investigation is to exclude iron, B12 and folate deficiency, and other reversible non-renal causes (Table 4).

Persistent normochromic normocytic anaemia with no other potential reversible causes should be treated with erythropoietin (EPO) in patients with lethargy or other anaemia-related symptoms. In patients with ischaemic heart disease or with left ventricular hypertrophy, EPO should even be given if the anaemia is asymptomatic. The starting dose is 50–150 U/kg/week; dose adjustments are made according to response. Within four to eight weeks, a significant rise in haemoglobin is to be expected (0.2–0.6 g/dl/week). During EPO therapy, iron-need may outstrip available body iron stores, reflected by a low level of serum ferritin, and iron supplementation is required. Hence monitoring of iron status during EPO therapy is essential. The serum ferritin level should be maintained well above 100 ng/dl and transferrin saturation at 20%. Oral supplementation of 200 mg of elemental iron/day will usually be sufficient.[59] If the level of hypochromic red cells rises above 10% in spite of oral supplementation, intravenous iron (100 mg elemental iron) may be required.[57, 60,61] Should haemoglobin fail to rise despite adequate iron supplementation, intercurrent infections and secondary hyperpara-thyriodism should be excluded as causes of a poor response.[62,63] Angiotensin-converting enzyme inhibitors and angiotensin receptor blockers have been reported to decrease the effectiveness of EPO therapy,[64,65] and discontinuation of such treatment may be considered if anaemia worsens within two months of its initiation. Once a normal haemoglobin level is achieved, the dose of EPO may be reduced by 25%. The aim of EPO therapy is to maintain the haemoglobin level as near to the normal range as possible, but at least at 12 g/dl. Potential side-effects of EPO therapy are hypertension, grand mal seizures, allergic reactions and pain at the injection site. After prolonged use, pure red cell aplasia has been reported in a small number of chronic renal failure patients.[66] Overall side- effects are rare, and benefits of EPO therapy outweigh potential risks.

Table 4. *Investigations for anaemia in patients with renal impairment*

	First line investigations	Second line investigation
	White cell count Haemoglobin concentration Mean corpuscular volume Mean corpuscular haemoglobin Platelet count Serum transferrin saturation level Serum ferritin level	
If macrocytosis noted		Serum vitamin B_{12} level Red cell folate level, TSH
If first line and second line investigation are normal and EPO initiated but response poor		PTH CRP

Renal osteodystrophy (ROD)

Renal osteodystrophy is the hallmark of chronic renal failure, and may occur relatively early. Secondary hyperparathyroidism is the main cause, however, hypocalcaemia and vitamin D deficiency also contribute. Bone pain, spontaneous fractures, proximal muscle weakness, soft tissue and periarthritic calcification are clinical features of renal osteodystrophy. In addition to renal osteodystrophy, osteoporosis and osteomalacia are common in older people and further increase the risk of fractures. Hyperparathyroidism worsens if serum phosphate levels remain elevated. Osteodystrophy usually becomes clinically apparent once the GFR falls below 30 ml/min.[67] Early treatment and regular monitoring (every three months) may prevent debilitating complications of renal osteodystrophy. Successful treatment of hyperparathyroidism may also lead to improvements in EPO responsiveness,[68] improvements in mobility and regression of left ventricular hypertrophy. [69,70]

First-line management is phosphate restriction where possible, and prescription of a phosphate binder such as calcium carbonate or calcium acetate (Table 5). Aluminium hydroxide should be avoided, as significant aluminium toxicity can occur with accumulation. Calcium-based phosphate binders may lead to hypercalcaemia. Newer non-calcium-based phosphate binders, such as selevamer, do not raise the calcium level and can be used as an alternative.[71] As the decline in renal function continues, supplementation of active vitamin D is necessary to control secondary hyperparathyroidism.[72,73]

Vitamin D deficiency

Older people with renal failure are at high risk of developing vitamin D deficiency. Not only is the failing kidney's capacity to convert 25-hydroxy vitamin D to 1.25 dihydroxy vitamin D decreased, but poor diet and inadequate exposure to sunlight also contribute. The latter is a particular problem in residents of care homes.[74,75,76,77] Vitamin D deficiency is associated with proximal muscle weakness, muscle and bone pains and pathological fractures, and may present with recurrent falls. Effective treatment can prevent or improve these symptoms. Vitamin D deficiency should be considered in all housebound patients, particularly in care home residents and in all mobile patients with renal impairment (Table 6). Treatment with activated vitamin D (1α Calcidol 0.25 μg three times weekly) should be considered if the intact serum PTH level rises to 2–4 times normal.[78] However, a daily lower dose of 1α Calcidol (0.125 μg daily) may be an easier drug regime to adhere to.[79]

Pruritus

Pruritus in patients with renal insufficiency is poorly understood, but very distressing. It may occur even in patients with mild renal insufficiency. While uraemic toxins are implicated as one of the causes, there is no clear relationship between the severity of uraemia and the occurrence of pruritus. Other potential causes of renal itch include hyperparathyroidism, abnormal cutaneous innervation, changes in the levels of endogenous opioids, enhanced skin mast cells instability, iron deficiency and zinc deficiency. Primary dermatoses, systemic causes and

Table 5. *Treatment of renal osteodystrophy according to the degree of renal impairment*

Renal function	Moderate renal impairment GFR 30–59 ml/min	Severe renal impairment GFR ≤30–15 ml/min
Laboratory markers	Serum calcium normal to ↓ Serum Phosphate normal to ↑ PTH ↑ Vitamin D3 ↓	Serum calcium ↓ Phosphate ↑ PTH ↑↑ Vitamin D3 ↓
Management approach	Dietary phosphate restriction Phosphate binders (Calcium carbonate, Selevamer) Calcium supplementation	Dietary phosphate restriction Phosphate binders Calcium supplementation Active vitamin D supplement

Table 6. *Stepwise approach for active vitamin D therapy*

Step 1: Initial step:
- Dietary phosphate restriction
- Correction of acidosis

Step 2: Start Calcitriol (0.25 µg thrice weekly or 0.125 µg daily) when:
- PTH >2–4 times upper limit of normal
- Serum phosphate ≤1.8 mmol/l
- Serum calcium ≤2.2 mmol/l

Step 3: Monitor PTH concentration every 3 months. Adjust therapy when:
- PTH rising in spite of 1 α Calcitriol therapy and serum calcium low/normal Increase 1 α Calcitriol to 0.5–1 µg thrice weekly
- PTH static in spite 1 α Calcitriol therapy → continue current dose
- PTH rising in spite of 1 α Calcitriol therapy and serum calcium high/rising consider parathyroidectomy

Table 7. *Clinical approach to pruritus in patients with chronic renal impairmant*

Exclude:
Other causes of pruritus than renal failure i.e. primary dermatosis, systemic disorders, psychological itch

Control:
Hyperphosphataemia with phosphate binder, avoid hypercalcaemia.
Exclude iron and zinc deficiency
Treat hyperparathyroidism

Trial of:
Ondansetron 4 mg twice daily
Naltrexone 50 mg daily
Topical application of 0.5% menthol cream of capsaicin (if pruritus localized).
UVB therapy

psychological causes should be excluded first (Table 7). Management of pruritus is difficult, and patients rarely respond to traditional antipruritic regimens. Antihistamines are usually ineffective, and emollients give at best temporary relief.[80,81] Topical application of menthol (0.5%) has been shown to be effective in some patients. Capsaicin may help in localized pruritus.[82]

Insomnia

Sleep disturbances are common in patients with renal insufficiency, and may have multiple causes.[83,84] These include daytime napping, leg cramps, sleep apnoea, pruritus and the restless leg syndrome. Sleep apnoea has been shown to improve following transplantation, suggesting that it is an effect of uraemia.[85] The patho-mechanism of sleep disorders associated with renal failure is poorly understood and treatment success remains poor. Before embarking on long-term hypnotic therapy, other potential causative factors should be established and treated.

Restless leg syndrome (RLS)

Restless leg syndrome is a common and distressing condition associated with renal insufficiency. Its prevalence in end-stage renal failure is 20–80%.[83,86] Pathophysiology of RLS is multifactorial and poorly understood. A plethora of therapies have been tried and a varying degree of symptom relief observed. Improvement of symptoms has been reported with low dose (0.5 mg/d) clonazepam, carbamazepine(0.5–4 mg), levo-dopa (100–200 mg/d) and low-dose clonidine (0.1–0.3 mg).[83,87,88,89] Quinine has no effect on restless leg syndrome.

Conclusion

Nephrology has more to offer than long-term dialysis and kidney transplantation. Diligent provision of basic but important conservative care as outlined in this article can slow down disease progression and provide significant improvements in the quality of life and wellbeing, without resorting to an unnecessary burden of long-term renal replacement therapy in frail older patients with multiple co-morbidities.

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