may then be taken both to achieve urinary continence and to preserve upper tract function. The common surgical procedures carried out include bladder neck reconstruction, bladder augmentation, and the placement of the artificial urinary sphincter. Perioperative urodynamic studies in children undergoing such procedures are standard practice in most major centres.

End stage renal disease in children requiring renal transplantation is associated with lower urinary tract obstruction in as many as 25%. Pretransplant urodynamics in these children will allow, if necessary, the construction of a urinary tract that will not prejudice renal function in the engrafted kidney. Cystometry is indicated in children with reflux where bladder dysfunction is suspected, especially if reimplantation surgery is contemplated, as a relationship may exist between severe vesicoureteric reflux and abnormal bladder activity.

Cystometry and videocystometry are invasive studies, the latter involving exposure to radiation. Recent advances include the availability of extended night time cystometry, with so called physiological filling of the bladder with the patient’s own urine. More recently ambulatory urodynamics involving a Holter type principle has permitted the recording of bladder pressure over many hours while the child goes about his or her normal activities. These studies provide a more sensitive index of lower urinary tract function than conventional cystometry and are of particular use in infants and younger children (such as those under the age of 5 years) who are often unable to cooperate with the more traditional techniques.

Urodynamics studies in general, and cystometric investigations in particular, are fundamental to the initial and on-going management of many children with urological abnormalities, particularly those with neurogenic bladder dysfunction. The value of these studies in children depends on careful patient selection together with sympathetic management of the child during the study.

MICHAEL D DINNEEN
PATRICK G DUFFY

Urodynamics Unit,
Department of Paediatric Urology,
Hospital for Sick Children,
Great Ormond Street
London WC1N 3JH

Dietary management in nephrotic syndrome

Nephrotic syndrome is characterised by heavy proteinuria, hypoalbuminaemia, and oedema with hyperlipidaemia. The majority of children with nephrotic syndrome have a steroid sensitive condition that is associated with minimal histological changes in the glomeruli (MCNS). The initial management involves the control of oedema and prevention of infection while awaiting the response to corticosteroids.

If the child does respond to prednisolone with infrequent relapses, then there are likely to be a few long term dietary problems. However, children who frequently relapse and are steroid dependent may require long term dietary advice to monitor and maintain nutritional status and prevent obesity. Growth and endocrine function are important issues in the long term management of such patients.

Initial advice

Growth parameters should always be recorded and dry weight estimated, as surface area is used to calculate the prednisolone dosage. A dietitian should be involved in the initial management both to review the dietary history as well as advising on the practicalities of the moderate fluid restriction that is often required in the initial oedematous phase while awaiting the response to steroids.

The basic advice is a "healthy eating" diet for all the family. It should provide adequate energy based on the estimated average requirement for children of the same chronological age. A protein intake of 1–2 g/kg body weight/day should be adequate for most children.

In the past diets containing increased intakes of protein (3–4 g/kg/body weight/day) were prescribed in the belief...
that they would help to restore serum protein pools. Animal studies, however, have shown that although dietary protein augmentation increased albumin synthesis it had no significant effect upon serum albumin concentrations or muscle protein as all of the additional ingested protein was catabolised to urea and excreted in the urine rather than used to promote growth. Alternatively there have been concerns that high protein diets may accelerate the progression of human and experimental glomerulonephritis and therefore the use of low protein diets have also been recommended. Although these diets have been shown to decrease proteinuria, there is the possible risk of malnutrition as suggested by animal studies. Such diets are also impractical to follow.

A ‘no added salt’ diet is advised when the child is oedematous and should ideally be followed as part of the general healthy eating advice in the long term. This can be done by omitting the addition of salt to food at the table and reducing the intake of highly salted manufactured foods, particularly snack foods such as crisps. Very low sodium diets and the use of low sodium specialist products should not be necessary. This advice can produce conflict within families and possible confusion. Follow up dietetic review in the clinic will help reinforce previous advice and help ensure that the diet is practical and not unnecessarily restrictive.

The use of monounsaturated or polyunsaturated margarines and oils are also advocated as part of the general healthy eating advice with a reduction of a saturated fat intake. Attempts at dietary manipulation of lipids in the diet may be more relevant in the child with a chronic nephrotic state.

A leaflet/booklet on healthy eating should be available to the family.

**Weight control**

Prednisolone treatment undoubtedly stimulates the child’s appetite and dietary advice about the prevention of excessive weight gain is important. Many children and their parents become upset with changes in body image, and this is particularly true with adolescents. In between meal snacks such as biscuits, crisps, and fizzy (high sugar) drinks should be avoided with low energy alternatives promoted. Healthy eating advice should again be reinforced. Occasionally contact with the nursery or school may be necessary as part of the psychosocial support required in some families.

**Food allergy**

As the aetiology of MCNS is unknown, there are some parents who become concerned that dietary factors may be responsible especially as MCNS is commoner in atopic families. There are reports suggesting food hypersensitivity, particularly to milk and dairy products, may be aetiological factors in the glomerular damage in both young and adult patients. If a trial of a few foods diet is contemplated it should be under close dietetic supervision.

One should be aware that some families may seek advice from alternative medicine sources, especially if they have concerns about the use of corticosteroids.

**Steroid resistant nephrotic syndrome**

This group of patients is usually very heterogenous with an underlying renal pathology that does not respond to at least four weeks of daily prednisolone treatment. Prolonged initial steroid dosage combined with oedema, ‘anorexia’, and catabolic state may require a period of nutritional support either with oral or nasogastric tube fed supplements. Vitamin supplementation and iron treatment may also be indicated. Such children are often hospitalised for long periods and the clinical course may be complicated by diarrhoea and other nosocomial infections from the ward.

**Hyperlipidaemia**

The management of hyperlipidaemia is controversial and could be of some importance if the nephrotic state is prolonged. The manipulation of dietary fat intake has a limited effect in reducing serum lipids and current interest is focused on the use of lipid lowering agents such as simvastatin. Although not currently licensed for children, we have maintained five patients with chronic nephrosis on dosages of 10 to 20 mg of simvastatin daily for up to three years with significant lowering of serum cholesterol concentrations and no obvious side effects.

**Congenital nephrotic syndrome**

This is a rare condition that in the past was associated with failure to thrive, progressive renal failure, and eventual death. If such patients are to survive they require intensive dietary support because of the anorexia that is complexed by fluid restriction. A protein intake of 2–4 kg/body weight/day with maximum energy intake within the fluid allowance may be indicated. Nutritional supplements will be essential to achieve nutritional requirements and administration by the nasogastric or preferably gastrostomy route will be indicated should the child fail to meet their nutritional requirements orally. The losses of protein can be reduced by unilateral or bilateral nephrectomy combined with early dialysis and transplantation.