

chances of subsequent arteriovenous communication. As we do not really know the cause or the true incidence of post-nephrectomy arteriovenous fistula, we should record in some detail how we deal with each pedicle and listening to the loin should be part of our routine follow-up examination.

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Diet in Chronic Renal Failure

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The dietary management of chronic renal failure has probably added a year or so to the life of the average patient with chronic renal disease; of prime importance is control of the intake of protein and electrolyte.

Protein

Over the last seven years our dietitians have experimented with natural food diets in an effort to find optimum intakes which anorexic patients in severe renal failure will accept with minimum rejections. Three standard diets of 20, 40 and 60 g protein content, made of foods readily acceptable to our local population, have been adopted and have been compared in patients with chronic renal failure on 22 mEq sodium intake. Urea production rate was measured by the ^{14}C -labelled urea turnover method (Walser & Bodenlos 1959, Robson *et al.* 1964).

In 5 of 6 patients on two different protein intakes, there was an appreciably higher urea production rate on the higher protein intake; in 5 studies 40 g intake causes a 28% higher urea production rate on average than the 20 g intake. We concluded that the 20 g diet is indicated when it is essential to minimize uræmia. However, in 6 out

of 9 patients on a 40 g diet, and in all 8 patients on the 20 g intake, urea production was greater than could be accounted for by catabolism of the exogenous protein alone. We concluded that on these restricted diets patients were catabolizing body protein, which was confirmed by weight loss and muscle wasting when the restricted diet was prolonged.

An analysis of these diets showed that the 20 and 40 g protein diets were deficient in calories (1,400 and 1,800 calories per day respectively) and only about one third of the protein was in the form of essential amino acids.

We tried the effect of correcting calorie deficiency by administering 20 g diets to 6 patients with and without a supplement of 850–1,700 calories per day in the form of Hycal – a liquid glucose preparation less sweet than most carbohydrate concentrates: there was a mean fall of 37% ($P < 0.02$) in urea production when the calorie supplement was added but the reduced rate was still higher than it should have been if only exogenous protein were catabolized (Robson *et al.* 1965).

Giordano (1963), Giovannetti & Maggiore (1964), Berlyne *et al.* (1966) and others have shown that if patients in renal failure are fed a diet of low protein content, with a high proportion of the protein yielding essential amino acids, they can re-utilize their own urea by unknown pathways to build protein, with a concurrent reduction in blood urea and relief of gastrointestinal symptoms. The effect is often quite dramatic (Fig 1). However, it must be pointed out that this regime utilizes unnatural spaghetti or unpalatable bread as the main source of calories and that these are unacceptable to a considerable proportion of British patients, particularly women. When used successfully these diets provide a much higher calorie content than conventional 20 g diets and we have found that if patients fail to eat all the diet they relapse into uræmia. It is therefore important to ascertain whether adequate calorie content is the main explanation of

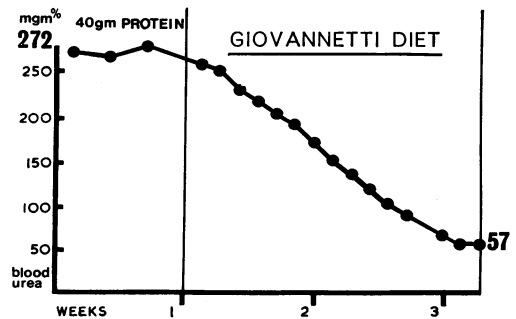


Fig 1 Fall in blood urea on changing from a 40 g protein diet to a 19 g protein Giovannetti diet

Table 1

Electrolyte content of a batch of potatoes boiled in two changes of water with a pinch of salt (mEq/100 g)

	Na	K
Raw	0.5	47
Boiled once	3.8	33
Boiled twice	5.3	23

Table 2

Stage in renal failure (GFR) at which dietary restrictions are usually imposed

	Glomerular filtration rate (ml/min)	
	Normotensive	Hypertensive
Moderate protein restriction	7	10
Giovanetti diet or 20 g with Hycal	4	7
Rigid sodium restriction	2	Depends on blood pressure; nearly always needed when GFR is below 10
Liberalize diet and start intermittent dialysis	About 2	About 4

their effect and we are currently comparing the Giovanetti diet with a conventional 20 g protein diet of approximately equal calorific value. In the first 3 patients studied there has been a further fall in urea production rate on changing to the Giovanetti diet suggesting that the high essential amino acid content has an important additional effect.¹

We have administered 20 g protein diets with Hycal and Giovanetti diets, usually with the same supplement, to 50 patients in pre-terminal renal failure and can confirm their effectiveness as long as the patient can eat the whole diet. Sometimes a period of dialysis is necessary initially to restore appetite before the diet is effective. In the minority of patients who remain normotensive to the end, low protein dieting is outstandingly successful and we have patients living outside hospital, albeit precariously, with GFRs of 1.5–2.0 ml/min.

Sodium and Potassium

Although sodium and potassium requirements are very variable in early renal failure and supplements are sometimes required, some restriction of both cations is usually necessary by the time a Giovanetti diet is prescribed. If the patient is hypertensive, sodium should be restricted and diuretics avoided if possible even if they are still effective.

Very rigid sodium restriction is required in the patient with malignant hypertension and a GFR below 10 ml/min. This makes dietary management so difficult that these patients have to be started on

¹This has now been confirmed in 8 of 10 patients

intermittent haemodialysis at a stage when their uraemia may not be critical; we have seldom succeeded in managing a patient with malignant hypertension and a GFR below 4 ml/min without dialysis.

Control of electrolyte intake calls for close co-operation between dietitian and biochemist, since there are many local variations in composition of foods and beverages. Brands of 'orange squash' on sale in Newcastle, although superficially similar and all, reputedly, derived from oranges, have potassium contents varying from 2 to 17 mEq/l. Draught and bottled beers have sodium contents from less than 1 to over 7 mEq/l.

We are indebted to Dr S Shaldon for pointing out the importance of pre-boiling potatoes in order to reduce their high potassium content. We have also been impressed with the importance of omitting salt from the water since it diffuses into the vegetable to a surprising degree, even when the boiling water is drained immediately after cooking (Table 1).

A summary of our current practice in dietary management is given in Table 2.

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Surgical Problems of Renal Failure

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Most patients suffering from renal failure have a reduced functional nephron mass as a result of parenchymal disease but a few cases of uraemia are due to obstruction of the drainage system of the urinary tract, which effectively slows down metabolite excretion. If the obstruction can be removed before permanent damage to the excretory system occurs, a good functional result may be expected; unfortunately a majority are complicated by infection proximal to the obstructing lesion, which accelerates pyelonephritic changes, making a complete recovery unlikely.