Doctor, how can I help to improve my mother's nutrition?

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Introduction

Nutrition is one of the most important factors affecting the survival of patients on renal dialysis but unfortunately 40-70% of dialysis patients are malnourished [(1)]. Emaciated renal patients have a high mortality rate despite adequate dialysis. Causes of the malnutrition include poor intake due to uraemia, inflammation, vascular access infection and other concomitant conditions. Correction of the underlying factors and increasing the oral intake are essential in improving patient survival. The following case may serve to illustrate the principles in renal nutrition.

Case history

A 94-year-old patient with diabetic nephropathy had been on haemodialysis (HD) for 4 years. Her cardiac condition deteriorated in the past few months. Physical examination showed that she had raised jugular venous pressure, the liver was grossly enlarged and there was pedal oedema up to the thighs. Her body weight (BW) after dialysis was 46.6 Kg and she complained of anorexia and orthopnoea. There was wasting of the body muscles.

In view of the fluid retention, water removal ('ultrafiltration') was increased during succeeding HD and her post dialysis BW was reduced to 42 Kg after two weeks. Her jugular venous pressure returned to normal, there was no hepatomegaly and the orthopnoea subsided. There was no pedal oedema but the muscle wasting became more prominent. Her appetite has improved.

Her relatives were pleased at the symptomatic improvement but they were shocked by the degree of muscle wasting which became more prominent after the subsidence of oedema. Her mid-calf circumference was 22 cm. Their question was 'doctor, how can I help to improve my mother's nutrition?'

Nutrition in renal dialysis patients

This patient has poor dietary intake due to the heart failure and fluid retention. The signs of malnutrition hard been partially masked by the oedema. In this case, her appetite improved after correction of the heart failure and fluid overload. Knowledge of renal nutrition management would be needed to correct her malnutrition.

The most important aspect is to maintain adequate protein and caloric intake. The protein intake in HD patients should be around 1.2 g/kg/day and in this case, the protein intake should be 50 gram per day, at least half of which should be of high biological value proteins such as meat and eggs. Protein intake can be measured by 'exchanges' and each exchange is around 7 gram protein. One ounce of meat or poultry or one whole egg constitutes one exchange. White meat such as chicken is preferred to pork or beef. For this patient, she would need to take some 5 exchanges of high biological value protein per day.

The actual protein can be estimated from the dietary history but it is inaccurate. Since dietary protein is turned into urea and excreted in the urine, the protein intake can be calculated from the 24 hour urine urea excretion[(2)]. This patient is on HD and the protein intake cannot be calculated in such manner because the urea was removed during HD. However, it can be calculated from the 'urea generation rate' which in turn was calculated from the blood urea levels between HDs and the rate is proportional to the protein intake. Other methods of nutrition assessment had been described elsewhere [(1)].

From kinetic calculations, her urea generation rate was 0.094 mmol/minute and the dietary protein intake was calculated to be 30 g/day only. Her serum phosphate was low at 0.58 mmol/l (reference range: 0.87 to 1.45 mmol/l) compatible with low protein intake (Figure 1).

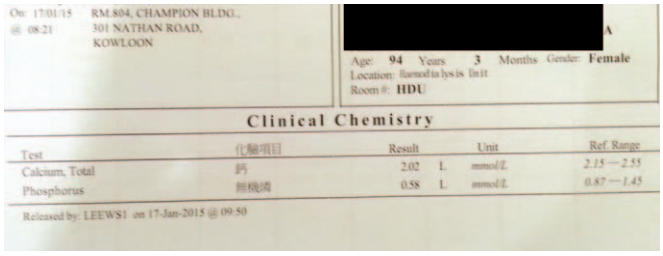

Figure 1: Low serum phosphate in ESRD patients may indicate malnutrition

Despite the fact that she had diabetes mellitus, adequate calorie intake must be maintained while the blood sugar should be controlled to within normal limits. At the age of 94, the life expectancy is expected to be less than 5 years and the blood sugar control could be 'relaxed' a bit.

The patient's appetite has improved due to the correction of the pulmonary congestion and it improved further on the correction of anemia with erythropoietin. The greatest barrier is that the patient may not have the appetite to take in all the 'prescribed' food to fulfill the protein and calories requirements. The best remedy is to encourage small and frequent meals. Variation in the food and cooking methods would also be useful.

The importance of serum phosphate

Patients with advanced renal failure have reduced capacity to excrete phosphate and it is common to find dialysis patients with high serum phosphate. Studies consistently showed that high serum phosphate is associated with a high mortality. Unfortunately, phosphate is present in most food items, especially in meat and beans, which are the sources of protein. As a rule of the thumb, one gram of meat (protein) contains 15 mg of phosphate and hence a 60 gram protein diet would incur a phosphate intake of 900 mg. It is estimated that about 75% of the phosphate would be absorbed and may contribute to the hyperphosphataemia.

This patient has low serum phosphate due to poor protein intake. After normalization of the intake, the phosphate is expected to be elevated.

To prevent hyperphosphataemia, one would need to avoid the food items with very high phosphate content such as animal internal organs like liver etc. (Figure 2). Egg white does not contain phosphate and the egg protein is of high biological value. It might not be practical to ask the patient to eat 2 eggs every days but some dietary 'tricks' like adding egg white to congee or steamed egg whites can make dishes attractive to the patients.

Figure 2: High phosphate food to avoid

Despite all these dietary measures, the serum phosphate may still be elevated. In that case phosphate binders would be necessary. They bind the phosphate in the food and were excreted in the stool. Phosphate binders can be aluminum based such aluminum hydroxide or calcium based such as calcium carbonate or calcium acetate. One gram of elemental calcium can bind about 150 mg of phosphate. They are cheap and would correct hypocalcaemia as well, but hypercalcemia is one of the side effects. New drugs like sevelemar or lanthanium carbonate are effective but they are much more expensive.

It should be noted that cola drinks contains phosphoric acid and is the cause of its brown colour. Phosphoric acid is metabolized to phosphate in the body. One litre of Coco-cola contains 520 mg phosphoric acid and thus Coca-Cola is not advised in renal patients.

Dietary supplement

There are many dietary supplements for boosting nutrition in the market. It ranges from simple milk powder to those 'renal formula'. They are milk based and broadly speaking, they can be divided into the 'renal' formula and 'non-renal' formula. The 'renal' formula has low electrolytes (including sodium and phosphate) content and high in protein (2 g/ml), taking care of the protein need of the renal patients. Such formulae include the 'Nephro' and the 'Renilon'). Some formula such as the Supplena has lower protein content (1 g/ml) and is suitable for the pre-dialysis patients. Some are available in powder form and some as readymade liquid form and some as both. The fluid preparation is more convenient but more expensive and takes up storage space.

If the patient is using those products as supplement and not as the sole nutritional source, there may be no need to use the 'renal formula' because the electrolyte load may not be high. The diet for the patient should be assessed individually, taken into account of his requirement and his usual diet.

Intravenous nutrition

For those emaciated patients whose oral intake is insufficient to meet the need, sometimes parenteral nutritional supplement is necessary. In general, enteral nutrition is preferable to parenteral nutrition because it is much cheaper, more physiological and safer. The main problem with parenteral nutrition solutions is that they have a high osmolality and it is damaging to the peripheral veins. Although there are preparations for peripheral veins administration, a central venous access is preferable. For those pre-dialysis patients or those with on continuous ambulatory peritoneal dialysis, a Hickman's catheter is usually used but there are risks associated with central vein cannulation such as pneumothorax or sepsis (Figure 3).

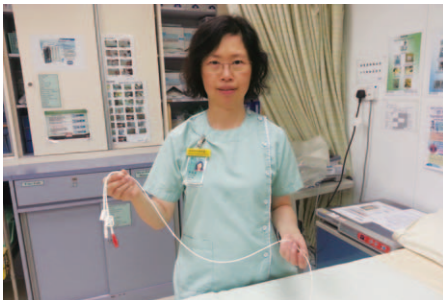

Figure 3: A Hickman's catheter

For some emaciated HD patients, it might be necessary to give the nutritional supplement through the intravenous route during the dialysis. Since there is a vascular access in HD patients, the nutrient can be administered during HD (Figure 4). The nutrition solution comes in one litre bags and there was a limit to the rate of the infusion. Since the usual dialysis is around 5 hours, the solution could not be administered in full and some of it would have to be discarded.

Figure 4: Parenteral nutrition during HD

Conclusion

Nutrition in renal patients is receiving increasing attention. To improve the nutrition state, it is necessary to correct the underlying causes such as inflammation, heart failure and anaemia. Oral feeding is to be preferred to parenteral feeding. The limiting factor may be the patient's appetite and small and frequent meals are useful. A caring family member with time and patience is the key to the success.

Declaration of interest

Dr. HO Chung Ping is the director of the Integrated Dialysis Facilities (HK) Ltd. There is no conflict of interest to be declared.

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