Hemodialysis—

in lieu of the artificial kidney

by William B. Blythe, M.D.

A decade now has passed since hemodialysis as a successful mode of treatment of patients with chronic renal insufficiency was first reported by Doctor Belding Scribner and his colleagues in Seattle. During these ten years, increasing numbers of patients have been treated by chronic hemodialysis, and even more would have been treated—and could now be treated—if sufficient funds were available.

This mushrooming growth of hemodialysis has brought with it not only greater opportunities for saving lives of patients otherwise doomed to death, but also myriads of medical, social, and ethical problems as well.

Clinical laboratories have been involved in the solutions of many of the problems, and, more often than not, without having an understanding of the aims, accomplishments, and problems of chronic hemodialysis programs.

In this article, I should like to present a brief, overall view of the chronic dialysis story in an effort to heighten the understanding of those laboring in clinical laboratories which, in turn, might, by making their labors more relevant, make them seem much more interesting.

The keystone to the successful operation and growth of chronic hemodialysis programs has been the development of techniques wherein repeated access to the circulating blood can be achieved and thus dialysis can be repetitive or chronic.

There are, in general, two prototypes of these techniques. The first is one in which inlying plastic cannulae are placed in an artery and a vein and connected to each other when the patient is not undergoing dialysis, thereby forming an arteriovenous shunt.

The second technique consists of actually creating an arteriovenous fistula surgically—usually in an arm—and in which access to the hemodialyzer can be achieved by inserting needles in the dilated veins caused by the fistula.

Although these techniques are not flawless, they have been quite adequate in providing a means for repetitive dialyses.

Another major feature in the growth of chronic dialysis has been the development of dialyzers which can be operated by paramedical personnel as well as the patients themselves and their families. The number of patients that could be treated would be sharply limited if a physician’s attention were necessary at all dialyses.

Patients are started on chronic dialysis when renal function is inadequate to maintain the internal environment in a state that is adequate for a reasonable and comfortable existence.

As a general rule, it is usually necessary for patients to be dia­lyzed once or twice per week, each dialysis lasting from six to twelve hours, depending upon the type of dialyzer that is being used.

In the case of most patients, it is necessary to restrict fluid in­take, and almost all will require greater or lesser restriction of protein intake.

Chronic dialysis nowadays is undertaken either in the home or in dialysis centers where groups of 5—40 patients may be treated.

Home dialysis is preferable where feasible, since the cost is much less due to the lack of need of trained personnel. However, there are patients who for various reasons—most of which are in the educational and socioeco­nomic spheres—are not suitable

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for home dialysis and must be treated in centers.

All are agreed nowadays that transplantation of kidneys will prove to be the ultimate treatment for most of those with chronic renal insufficiency and that dialysis will be mostly for preparation before and support immediately after transplantation. Thus, the need for dialysis programs will not be substantially decreased as long as there are patients with chronic renal insufficiency.

It is difficult to obtain figures that accurately reflect the cost of chronic hemodialysis. Estimates range between $10,000-$15,000 per patient per year for patients undergoing dialysis in dialysis centers. The cost of home dialysis is considerably less with the estimated costs ranging from $4,000-$6,000 per year.

It is encouraging that equipment costs have decreased considerably since chronic dialysis became feasible, and it appears that relative costs are continuing to decrease.

The problems of patients on chronic hemodialysis programs are a reflection of the fact that the artificial kidney is an inadequate substitute for nature’s kidney, both from the standpoint of its capabilities and because there are problems that are inherent in artificial organs.

In the first category belong those aspects of uremia which persist despite chronic dialysis. The most prominent of these are anemia, disorders of bone and calcium and phosphorus metabolism, peripheral neuropathy, and pruritus.

In almost all patients, anemia of varying degrees persists, although improvement in various aspects of the anemia has been noted following dialysis.

For example, improvement in post-dialysis erythrocyte iron incorporation, when compared to pre-dialysis values and without appreciable change in plasma concentration or erythropoietin, has been demonstrated.

This finding, coupled with the fact that transfusion requirements become less in many patients after a period of chronic hemodialysis, suggest that erythropoiesis may increase without an increase in erythropoietin.

As is the case with anemia, almost all patients who undergo chronic dialysis sooner or later develop manifestations of disordered bone and calcium and phosphorus metabolism.

It is almost inevitable that disorders of this type should appear since calcium is either being added to, or taken away from, the body unless the concentration of calcium in the hemodialyzer bath fluid is exactly the same as the plasma ionized-calcium concentration. Thus, most patients show evidence of demineralization of the skeleton and/or metabolic calcification.

To complicate matters, the “resistance” to vitamin D that uremic patients demonstrate is not corrected by chronic hemodialysis, and some degree of hyperparathyroidism is most often present.

Polyneuropathy in varying degrees is always seen in patients undergoing chronic hemodialysis. It may vary in severity from asymptomatic slowing of motor nerve conduction to severe, crippling neuropathy. Although neuropathy often responds to increasing the dialysis time, it does not invariably do so.

Pruritus is usually no more than a mild inconvenience to the patient, but occasionally it is severe and obstreperous.

Problems in the second category—those associated with the therapy per se—are also frequent and vexing. They include the various hazards of repetitive transfusions, problems with frequent anticoagulation, cannulae problems—particularly episodes of clotting and infection—as well as a syndrome called the dysequilibrium syndrome, which is associated with too rapid dialysis and characterized by hypertension, convulsions, and occasionally death.

Furthermore, there are problems associated with patients being unable to adapt to this less-than-normal situation in which they are placed. Depression is common, and suicides occasionally occur.

Frequently, the behavior of patients on chronic dialysis is self-destructive; that is, they will go on fluid binges, or eat forbidden foods, or neglect the care of the cannulae.

It should be clear that dialysis programs cannot operate in isolation and that numerous kinds of support—notable among them the support of clinical laboratories—are essential for adequate operation of a dialysis program.

In spite of the numerous associated problems, dialysis programs are vitally needed in the treatment of patients with chronic renal insufficiency.

It is essential that adequate funding be supplied—and soon.

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