Some Important Factors in a Community Dialysis Program*

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The purpose of this paper is to acquaint physicians who are not nephrologists with the experience of one of their colleagues in the operation of a hemodialysis service as a part-time endeavor. My intention is not to present detailed or advanced scientific data on dialysis techniques or on the care of chronic renal failure but to discuss how and under what circumstances the urologist, internist, or general physician might significantly augment the present treatment care system for end-stage chronic renal disease. I will attempt to describe a mode and philosophy of operation applicable to the community hospital and private practice setting which is derived from our experience in providing care for acute and chronic renal failure in a city of 50,000 with a service area of 300,000 people located more than one hour from the nearest large medical center. Our unit started with one machine and one patient five years ago and now has seven dialyzers serving an average case load of 13 patients.

The need for increased personnel and facilities for the care of patients with end-stage renal disease is well established. It is generally estimated that each year 40–60,000 patients die from chronic renal disease; 8,000 might benefit from chronic dialysis and/or renal homotransplantation.

The January 1973 report of the National Dialysis Registry showed 7,498 patients on dialysis at 424 centers in the United States in contrast to 100 patients at 25 centers in 1964. The statistics indicate a fairly rapid development of facilities for dialytic therapy in the United States, but obviously the system cannot provide treatment to many more than 25% of the patients who might offer themselves for care. Historically, of course, most of our dialysis centers have been established at our university hospitals. Because of shortages of space and funds at these institutions, however, in addition to their limited geographic distribution, it is not reasonable to expect that the very substantial increase in facilities needed can occur at these centers. The university hospital can, however, be of great assistance in training patients for home dialysis and in the direct or indirect technical support of smaller units in other communities. It certainly is reasonable to expect that community dialysis centers, their costs lessened by more freely available space, decreased transportation expenses and greater flexibility in personnel, might provide a significant opportunity for expansion of our treatment capability. In our smaller cities the case material may not be sufficient to support a full-time nephrologic practice where the urologist or other interested physician might consider establishing a dialysis unit. The decision must be predicated on a number of factors; the first is the need in a general geographic area. It is generally estimated that there are about 38 patients per 1,000,000 persons per year who will benefit from chronic dialysis or transplantation. A small part-time service can probably be justified by an influx of four patients per year considering that some patients may be on chronic dialysis without consideration for transplantation, and even those registered for cadaveric transplants in a very active organ exchange program will usually have waiting periods of about six months before a transplant. We will discuss cost factors of importance in determining the practicability of small dialysis units in some detail later.

Another factor that must be considered, of course, is the distance patients must travel to existing facilities. If a patient must travel more than two hours
round trip for a dialysis, the actual cash cost of dialysis to the patient may be increased as much as $2,000 to $3,000 per year and, more importantly, the burden on him and his family in terms of fatigue and time lost from work can be prohibitive. If such a situation exists in your community it might provide further encouragement to attempt to establish dialysis facilities locally. Another factor to be considered is the availability of space suitable for dialysis. The physical requirements of a unit are not elaborate, requiring only electricity and hot and cold running water. It should be convenient to the director and his staff and, ideally, adjacent to the physician's office so that his staff might relieve each other for lunch or assist in the event of mechanical or clinical difficulties. The natural tendency is, of course, to consider using hospital space for a unit. With current hospital construction costs of $55–75.00 per square foot, however, the general shortage of space in our hospitals, and the fact that empty space that might be used for patient care is a potential source of income of $25–40,000.00 per bed per year, it may not take long before either the hospital wishes to use some of the allocated space for other purposes or one finds that space needed to expand the dialysis unit is not available. In our experience, the undeveloped basement of our offices provided, with relatively minor alterations at a cost of $8,000, a satisfactory facility to dialyze seven patients at a time with room to expand easily to nine, and at a negligible fixed overhead (fig. 1). Similar flexible low cost facilities might be established in empty apartments, stores, or in unused portions of medical offices.

An additional factor to consider is the coverage
available when the director is away on holiday or at medical meetings. This is generally not as great a problem as it sounds because a technician with six months of fairly active experience can deal with all but true medical emergencies and another physician can usually be found who will take at least a peripheral interest in one's unit. The most important medical support necessary is advice at a distance from an experienced nephrologist, preferably from an institution with an active dialysis and transplantation program. It is unlikely that the urologist or other general physician by virtue of his training will share all the knowledge of a nephrologist, and contact from time to time is most helpful. I have shared patients with the renal and transplantation units at the University of Virginia Hospital, Medical College of Virginia, and Duke University Medical Center and found without exception that they were most enthusiastic about having another facility in their general geographic area and anxious to be of assistance. In fact, half of our new patients in the last two years were referred from these hospitals for treatment. The other advantage of close liaison is that it is important for a fair proportion of patients in a small dialysis unit to be registered in an active transplant unit. It is obvious that unless patients are transplanted with some regularity and with an attrition rate of about 10% per year on dialysis, one's unit will rapidly fill and have no room for next year's patients.

Lastly, the most important factor to consider is your own enthusiasm and the firmness of your commitment. Supervising a dialysis unit can be a most satisfying avocation. Yet, it requires a rather substantial and permanent commitment, and certainly, it is not the sort of thing that one would choose in making the transition between flying lessons and finger painting. If one would anticipate that the day to day supervision of dialytic therapy would probably become a tedious matter, it is probably best not to start. There are few other fields, however, which can provide the personal satisfaction of supplying a vitally needed medical service. In all our offices from time to time, we feel progressively estranged from our patients by the demands of third party payers, the Columbia Broadcasting Company, and ever increasing case loads. Chronic dialysis is one field in which the doctor-patient relationship is closer and more direct than in almost any other area in medical practice, and this itself can be most rewarding.

Having decided to commit oneself to starting a unit, there are two further pitfalls to avoid. The first is the tendency to start too elaborately. I know of at least two instances in Virginia where hospitals considered establishing a dialysis unit involving plans calling for major remodeling with complex central dialysate delivery systems and quite a large number of dialyzers. The cost estimates ran into six figures and the institutions abandoned their plans before getting started. While I am sure that central delivery systems and other refinements in the physical plant can be of distinct economic benefit in large established units, their cost and the loss of flexibility incurred by having a substantial initial capital investment are distinct disadvantages in starting a small unit. At the present time, it is possible to purchase an entirely adequate new dialyzer for as little as $1,800 and sufficient supplies to dialyze a patient for six weeks with an additional $330. This general type of equipment is rather portable, requiring only a water source and drain and a grounded electrical supply, thus giving one the opportunity to move the unit at will if larger and otherwise more suitable quarters become available. Additionally, a prudently used dialyzer can be sold much in the manner of a used car if the physician involved becomes disenchanted. The point is that there is no need to make a large and fixed real estate or equipment investment with the sort of commercial equipment that is available from a number of sources. Another reason for starting small is that an area not previously serviced by a hemodialysis unit will not be oriented toward referring patients for care of chronic renal failure. The number of new patients in the first year or two may be smaller than one might anticipate. As time goes on, even drawing from the same geographic area, the number of new patients seems to increase each year as internists, family physicians, and pediatricians become oriented toward optimum treatment of those afflicted with chronic renal failure. We had three new patients in our first year of operation and seven new patients in our fifth year.

The second detour to avoid is to start with the idea that one will do acute or emergency dialyses and avoid taking care of chronically ill patients. As a practical matter, it is virtually impossible to maintain equipment and achieve a standard of excellence in the performance of technicians unless they are dialyzing regularly. Quite a large number of community and university hospitals, having attempted to start in this manner, almost invariably have found it necessary to begin at least some chronic dialyses
to avoid loss of their equipment or having it fall into disrepair and the personnel need continual practice to maintain their competence. The primary reason for this is that the patients requiring emergency dialysis are relatively few and in most instances are best treated by peritoneal dialysis. The indications for acute dialysis might be simply summarized as follows:

1) Temporary dysfunction or hypofunction of the kidneys because of acute and potentially reversible renal disease.

2) Correction of intractable edema or severe electrolyte disturbances.

3) Removal of potentially toxic substances.

In the first two categories above, peritoneal dialysis is generally preferred in the absence of a relative contraindication to that procedure, such as abdominal wall sepsis, advanced pregnancy, bleeding diathesis and so forth. Patients in category 3 are usually best treated by hemodialysis. A considerable body of evidence is emerging, however, that dialysis is of little benefit in intoxications particularly when due to lipid soluble or protein bound agents and is generally not indicated except in the gravest circumstances. To illustrate this point, in the past three years we have performed approximately 2,400 chronic hemodialyses and only 34 acute hemodialyses on 14 patients; the types of cases encountered in these 14 patients were as follows:

1) Intractable edema, two (one died).
2) Thrombotic thrombocytopenic purpura, three (one died).
3) Glutethimide intoxication, two (one died).
4) Interstitial nephritis secondary to ampicillin, one patient.
5) Acute tubular necrosis post surgery, five (four died).
6) Polyarteritis nodosa, one patient.

While one might gather that some of the most rewarding experiences were found in the group treated with acute hemodialysis, the need to perform this procedure is rather infrequently encountered and would probably not, in our context, permit the effective functioning of a dialysis team. In performing chronic dialysis regularly, the maintenance of our staff's skill and equipment permits us to begin an emergency hemodialysis within 25 minutes providing adequate vascular access is attained. Interestingly enough, the more active a chronic service becomes, the greater becomes the skill and confidence of the paramedical personnel, and the directing physician is less burdened with the technical aspects of dialysis. Our experience is that it requires less time to supervise the care of thirteen patients now than it took to supervise four patients three years ago.

The choice of patients to be offered care is obviously a matter which must be faced. Many institutions maintain dialysis selection committees, often including laymen, to determine which patients are to be treated. In my experience there are a number of disadvantages to this approach. First, it is contrary to the basic traditions of our civilization to try to place a relative value on a given patient's continued existence, and as a practical matter, there is no one, neither physician nor layman, who is very accurate in determining who will be a cooperative and conscientious chronic dialysis patient. Two of the very best patients I have been privileged to look after were turned down at other centers, one because of lower than average intelligence and the other because of a criminal record some years before. Finally, since many chronic renal failure patients appear rather suddenly and in dire straits, it is often difficult to learn much about them socially and psychologically before one has to make the medical decision as to the desirability of chronic maintenance. Our policy is to offer chronic dialysis to all patients who do not have other medical conditions which preclude rehabilitation. When selecting by medical criteria alone, one will find a somewhat higher attrition rate than in highly selective centers because a number of patients will opt out either voluntarily or involuntarily as they find they are unable to conform to the rather rigorous discipline which is part of the daily life of a successful chronic dialysis patient. This mode of operation is bound to lead to some disappointments, but in most circumstances it is vastly preferable to leave the nonmedical decisions to the patient and his Maker than to another human being who is really ill-equipped to decide.

The next problem that faces the small unit director is the establishment of satisfactory vascular access for once- or twice-weekly treatment. Historically, of course, chronic dialysis emerged as a practical treatment system with the development of the Scribner-Quinton teflon-silastic shunt in the early 1960's, and many chronic dialysis patients still use these devices. They provide ease and rapidity of connection to the dialyzer and rather predictable flows; effective care generally requires average flows in excess of 200 ml per minute. However, they are subject to disruption and the possibility of exsanguin-
nation. They are also susceptible to infection and clotting and require a substantial inventory of expensive tubes and tools. Many large centers and most home dialysis patients use shunts, but in small dialysis units such as ours, the internal A-V fistula as developed by Brescia may be the preferred method for providing access. Although starting a dialysis on a patient with a fistula is slightly slower and requires a higher level of training, fistulas are rather free of clotting and infection and require only needles or cannulas as ancillary equipment. In our unit, fistula flows have been comparable to those of shunts once the fistula has been established for a month or two. A third technique, percutaneous puncture of the femoral vein as developed by Shaldon, has been used very effectively in chronic patients in other units and in ours as a temporary measure while awaiting maturation of a fistula. The venipuncture required is more difficult than in a fistula and is less easily relegated to one’s staff in our experience.

As far as dialysis is concerned, I have referred above to the desirability of having a small self-contained unit. We started using the recirculating single pass twin coil unit such as is available commercially through Travenol Laboratories. The merits of various dialysis apparatus are a subject for hours of debate and beyond the scope of this discussion. The versatility of the Travenol unit, however, is advantageous for a small program because it is able to remove both excess metabolites and fluid, has a single source for all components and technical assistance and has ease of assembly and disassembly, thus reducing training time and, of course, cost of operation. There are, certainly, many other effective commercial dialyzers available with very competent support for the small unit. Our last two dialyzers are made up of Life Med control equipment and Dow capillary kidneys for which we have fine outside support and which provide some technical advantages with certain patients. One of the factors that might influence the final choice of equipment is the kind of hardware in use at the nearest large center. If one is going to have his personnel trained at or exchange patients with a nearby center it might be beneficial to use similar equipment as both staff and patients will profit. At any rate, I think one can anticipate a great deal of help from any of the major equipment sources.

One matter that must be considered is the financial support of your patient’s care. Each health insurance company and state has its own policy. In general, even in states with conservative fiscal tra-
ditions, however, patients who are totally disabled from chronic renal failure will find at least partial support from Medicaid or the Vocational Rehabilitation Departments. Cost control is of prime importance. The three factors most amenable to control are personnel, disposable equipment, and physical overhead. I have previously stressed the advisability of having dialysis technicians with a variety of skills as being of great importance for a small unit. Experience has indicated that the optimum cost-effective and clinically efficient patient-to-technician ratio is three or four to one. Therefore, since dialyzers per se are rather inexpensive, in a three- or four-patient service, it is usually less costly to dialyze four persons twice per week than two persons four times per week, assuming your technicians can work elsewhere as office nurses or in some other capacity on the remaining days. The critical factor is flexibility in personnel and a constant evaluation of the most cost-effective way to organize their activities from time to time as the patient load of one’s unit varies.

With respect to disposable equipment, the single largest element in cost is the coils. There has been a progressive decrease in the cost of commercial coils from $22 to $15 each over the past two years, and further decreases to just over $10 per coil are anticipated in the next few years. To parallel this, there has been considerable interest in reusing coils, and there are a variety of techniques described in the literature for cleansing and preserving them for reuse. Our experience would indicate that often in small units, the personnel costs involved in preserving coils do not permit highly significant savings.

The third area where cost reduction may be effected is in decreasing the actual physical overhead of dialysis as I mentioned previously. The detailed cost analyses are available in the literature, the best one of which, in my opinion, indicates a cost of $130 per dialysis for hospital units and $69 and $46 for satellite and home dialysis, respectively. These reductions reflect, of course, lowered physical overhead and travel expenses and, in the case of home dialysis, lowered personnel costs. While there is considerable enthusiasm for home dialysis in many quarters, I doubt that home therapy will be the method used to bring dialysis to the majority of patients who need it. While it is highly effective in selected patients, there are simply large numbers of patients or patients’ families who either by virtue of their timidity or
limited background cannot perform dialysis at home. Also, there are still significant numbers of patients in rural areas and in lower class urban America whose living quarters simply do not permit the installation of a dialyzer. At one time, we surveyed our service of ten patients and found that three had no indoor plumbing in their living quarters; an additional two did not have hot water and one other patient was illiterate. Of the two chosen for training for home dialysis, one refused the opportunity and the other, after a considerable amount of training, requested that he be allowed to continue coming to our unit. One factor that must be faced is that many rural counties in the southeast have adult populations with an educational level of less than seven years, and this places a substantial limitation on the number of people who can be trained efficiently to care for themselves. One cannot help but be impressed with the results of our colleagues in the state of Washington who are training large numbers of patients for home dialysis. It is obvious, however, that they are working in a different social milieu and are able to commit rather large amounts of money to evaluate special techniques for training large numbers of home dialysis patients. Additionally, while all dialysis patients are subject to depression and other rather serious psychiatric problems, home dialysis patients and families seem to have very high rates of divorce, suicide, and secondary spouses. In any event, two-thirds of all dialysis patients in the United States are in centers as opposed to home dialysis programs, thus indicating that the latter may not be as universally applied as has been indicated in some quarters.

If one's unit continues to grow in size, the point will be reached where its demands will exceed the skill and energy of a part-time director. In our case, that point was reached 12 months ago, at which time we had grown to eight patients being dialyzed on four machines. We were able at that time to add a highly qualified nephrologist to our group. Our unit has since grown to 13 patients and seven machines, and we are presently performing 100 dialyses per month. Five of our patients had cadaveric transplants this past year through the Southeastern Regional Donor Program; three of them retained kidneys at this time. The development of our dialysis service to the level where a nephrologist was required has, of course, resulted in the addition of considerable expertise in the management of renal disease and hypertension in our community.

In closing, I hope I have imparted some valuable information not easily available in the literature based on our own practical experience in the operation of a small part-time dialysis unit. I think I can assure interested physicians that as one's knowledge and skill develop in this area, the operation of such a unit will be a progressively rewarding and stimulating experience.

BIBLIOGRAPHY


**HOFFMAN: COMMUNITY DIALYSIS PROGRAM**


