The Diabetic on Dialysis

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"Renal disease is now the cause of death in about one-half of the young diabetics.[1]" Yet, until recently, hemodialysis has not been considered among the logical alternatives in the treatment of renal failure in the diabetic patient. Even today many dialysis centers do not accept such patients. However, it is not the purpose of this paper to decide whether dialysis of the diabetic is "right" or "wrong", but, rather to present a brief view of the problems the technician or nurse may encounter while working with this type of patient on dialysis.

Diabetes mellitus, henceforth referred to only as diabetes, reflects a disturbance wherein the ability to oxidize and utilize carbohydrates is lost. It is caused by a deficiency in insulin, an internal secretion of the pancreas, resulting in glycosuria, an abnormally high sugar content in the urine, and hyperglycemia, an excess of glucose in the blood. This disorder leads to abnormalities in protein and fat metabolism as well. In prolonged and severe diabetes the accumulation of glucose and fat in the blood may cause damage to the blood vessels and to tissues and organs. Complications involving the kidney, specifically nephrosclerosis, hardening of the kidney associated with hypertension and disease of the renal arterioles, pyelonephritis, inflammation of the kidney and renal pelvis, and glomerulosclerosis, arteriolar nephrosclerosis, are very common among persons with long standing diabetes. It is when these complications arise and chronic renal failure develops that the question of dialysis and its ensuing problems arise.

It is known that glomerular changes represent a frequent complication of diabetes mellitus. Referred to as the "Kimmelsteil-Wilson Syndrome", diabetic glomerulosclerosis is an accumulation of "hyaline" deposits which reduce the filtration surface of the kidney. Eventually, enough glomeruli are destroyed to cause a diminished renal function and chronic renal failure. It is with this type of renal failure that we are concerned with in this paper.

In order to achieve total patient care of the diabetic on hemodialysis the technician must first be aware of the problems associated with diabetes as well as those associated with chronic renal failure. The technician must then be able to provide a rational care plan for the diabetic while on dialysis. The problems he must be aware of fall into the broad categories of diet, circulation, activity, medication, and psychological.

DIET

Both the kidney patient and the diabetic are placed on restricted diets. It will be part of the duty of the technician to help the dietician and the patient to maintain a

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[1]Marvin D. Siperstein, Arthur R. Colwell, Sr., and Karl Meyer, *Small Blood Vessel Involvement in Diabetes Mellitus* (Washington D.C.: American Institute of Biological Sciences, 1964) p. 862.

diet fulfilling requirements of both diets. The diabetic is placed on a specified caloric intake ADA (American Diabetic Association) diet consisting basically of foods high in nutritive value but low in concentrated sweets. When diabetes is complicated with renal failure further restrictions are placed on the diet. The patient will be required to limit his sodium intake, sodium acts as a water retaining mineral, to approximately two grams per day, and his potassium to between two and two and one-half grams per day. These restrictions will mean an even more limiting diet with many of the original foods on the exchange list now being omitted.

Furthermore, the problem of fluid intake will have to be dealt with. Diabetes mellitus is characterized by a condition known as polydipsia, or increased thirst. Prior to kidney failure this is compensated for by polyuria, or excessive urination. However, with decreased renal function the diabetic will now have to limit his fluid intake, dependent upon urinary output and blood levels or urea and electrolytes, to between four hundred and eight hundred ccs. intake per day.

The technician will be required to keep an accurate record of intake and output of the patient while on dialysis. The record should cover all input, including the amount of saline received during both hook-up and retransfusion, all IV administrations such as Albumin and blood, and all oral intake. Output should also be recorded carefully and accurately, including any elimination and emesis.

Another essential function of the technician will be to teach or re-emphasize the importance of a nutritious, well balanced meal as well as the necessity of limiting ones fluid intake.

Finally, the technician should be aware of the importance of keeping meals on a regular schedule. Among the most disagreeable effects of uremia are those on the alimentary tract, as the patient experiences anorexia, nausea and vomiting. Regularly scheduled meals will help the patient to adjust to a schedule and accept the food more readily. Furthermore, on a diabetic diet it is stressed that all food be eaten at a prescribed time, especially when insulin is part of the regime. Insulin is discussed further under medications.

CIRCULATION

In diabetes, particularly with diabetic acidosis, the cardiovascular system weakens and eventually fails. As previously indicated, this is due to an accumulation of glucose and fat in the blood. Besides kidney failure already discussed, the effects on the over all integrity of the vascular system are numerous and the technician should be aware of the problems which could arise.

Primarily, the technician should note the increased chance of heart problems in the diabetic. Bell states that, "deaths from Coronary Heart Disease were about 40% higher in diabetic than in nondiabetic patients."[2] This is attributed to the fact that there is an increased incidence of hypertension in the diabetic, due to the atherosclerotic condition of the vessels, coupled with an increased susceptibility of the heart to the hypertensive condition.

In handling this situation the technician should pay particular attention to the symptomatic changes occuring while on dialysis. One such change might be a drop in blood pressure resulting in decreased blood supply to the heart and to angina, especially while on dialysis.

[2]Samuel J. Kimura, M.D. and Wayne M. Caygill, M.D. *Vascular Complications of Diabetes Mellitus* (St. Louis: C.V. Mosby Co., 1967) p. 114.

Similarly, angina can be caused by a low hematocrit which means the heart is receiving a diminished supply of oxygenated blood. Hematocrits should be checked with each dialysis, and an accurate record kept so that decreases in the hematocrit, whether an unusual or gradual decline, can be observed. Frequent transfusions for the symptomatic patient may be required.

Finally, the technician **must** be made aware of while patients are on a form of digitalis so that potassium may be added to the dialysate as per physician orders. When dialysing the patient on digitalis the addition of potassium to the dialysate increases the concentration of potassium in the dialysate and thus decreases the removal of potassium from the serum. Without the added potassium in the bath the decrease in the serum potassium of the patient on digitalis could result in possible arrest from ventricular fibrillation.

Secondary to the increased heart problems is that of the increased chance of infection, also caused by diminished circulation. Because of a decreased blood supply due to atherosclerosis and a high level of sugar in the blood, the diabetic is more susceptible to infection, particularly in the extremities, than the non-diabetic. Extra care should be taken in every regard to infection.

Of particular concern for hemodialysis is the access to the blood stream. With either a shunt or a fistula the direct contact with the blood presents an excellent medium for bacterial growth. Strict sterile technique should be used whenever a shunt is hooked up and equal precautions with regard to the possibility of infection of a fistula must be exercised.

Another problem involving the possibility of infection is the development of decubiti. Particularly with patients on bedrest, applicable to those who spend hours in bed while on dialysis, care must be taken to avoid positioning the patient the same way or on the same area for more than a short while of time. Once a bedsore has developed extra care to avoid further breakdown of the tissue is necessary. Keeping the area dry with maalox rubs and heatlamp treatment will help the decubiti granulate and heal.

Thirdly, and finally, is the problem of thrombus formation. Caused by a combination of decreased circulation to the extremities and excess fat in the bloodstream, this is an important problem to the technician who must exercise all caution in maintaining an open and usuable access to the blood stream. The technician will find that both shunts and fistulas will have a tendency to clot easier in the diabetic than in the non-diabetic patient. Effective teaching in the maintenance of a shunt, involving checking the shunt for patency and infection, will be part of the technician's role. With a fistula he will have to teach the patient to exercise and develop the fistula for better and longer use.

ACTIVITY

The diabetic is plagued by a further complication of general weakness caused by metabolic disorders. This fatigue is most important when viewed in relation with other previously mentioned problems. For example, fatigue results in inactivity which leads to a decreased appetite. Since appetite is already poor, this only complicates nourishment further.

Similarly, weakness and fatigue can further complicate the already numerous problems with the circulatory system.

	PROBLEM	ACTION	RATIONALE
Diet	Revision of ADA diet to meet further restrictions of "kidney" patient diet	Teaching — low sodium, 2g / day, low potassium, 2-2.5g / day, modify ADA diet by omitting those exchange foods not compatable with above restrictions.	In diabetes fat is not metabolized properly, along with carbohydrates and should be restricted even though recommended on the dialysis diet Low sodium: to avoid water retension Low potassium: to avoid electrolyte imbalance
	Fluid restriction vs. Polydipsia	Daily weights Strict Intake and Output Fluid Restriction	To avoid excess water retention, and edema
	Coronary Heart Disease	Digitalis, etc. Observe for symptoms Change in blood pressure Drop in hematocrit Angina Edema	Diabetics have a decreased blood flow due to arteriosclerosis resulting from inadequate fat metabolism Diabetics have a hypertensive state due to arteriosclerosis Patients have a tendency for greater fluid retention
	Increased susceptibility to infection	Sterile or aseptic technique Avoid trauma Teaching cleanliness	Decreased blood flow due to arteriosclerosis and high levels of blood sugars lead to increased susceptibility of infection in diabetics Direct access and contact with blood flow

	Decubiti formation	Encourage movement while patient is on bedrest Keep boney prominences padded Sheepskin padding on bed Once a bedsore has developed keep area clean and dry and if necessary use heat lamp to aid in drying	Due to a decreased blood supply resultant from arteriosclerosis, and pressure on the area, the 0_2 supply is interrupted leading to an increased chance of necrosis.
	Thrombus formation	TED hose Movement in bed while on bedrest Range of Motion (passive) Elevation of legs	Arteriosclerosis due to incomplete fat metabolism Introduction of foreign element, ie: shunt or catheter, into bloodstream Possible hemolysis of blood while on dialysis Bedrest causing a pooling of blood
	Retinopathy	Tight Heparinization	Weakened retinal vessels due to arteriosclerosis Bleeding enhanced by heparinization
Activity	Weakness	Passive ROM Up with aid, safety measures	Increased Glucose in the blood increases weakness and fatigue
	Neuropathy	Aid patient in activity Comfort measures	Nerve damage caused by uremic condition
Medications	Heparinization resulting in bleeding (Retinopathy)	Tight heparin Clotting times Protamine sulfate (rarely)	Weakened vessels, particularly in eyes, burst and bleed. This condition enhanced by heparin
	Insulin	Frequent sugar levels of blood Watch for impending shock or coma	Insulin is used to return carbohydrate metabolism to as close to normal as possible
	Digitalis	Add Potassium, added to bath Watch for symptomatic problems	Prescribed for patients with Coronary Heart Disease

MEDICATIONS

The majority of medications taken are metabolised in the liver and excreted by the kidneys. With chronic renal failure and reduced renal filtration medications remain in the blood with a prolonged effect. For this reason, medications are used as needed, but judiciously, since small amounts may have exaggerated effects.

Renal insufficiency is the outstanding contraindication to the use of mercurial diuretics. Under this circumstance there is a danger of systemic mercury poisoning due to the inadequate secretion of the drug. There is also the possibility of aggravation of existing renal damage. The acute glomerulonephritis associated with diabetes is probably an absolute contraindication.

Barbituates are not recommended either, particularly those of long action. When renal function is impaired those barbituates which depend on the kidney for elimination may cause severe CNS (Central Nervous System) depression. Furthermore, uremia may increase the sensitivity to barbituates.

Digitalis is a drug which is often used with diabetic patients due to the increased incidence of Coronary Heart Disease. However, it is necessary to decrease the dose because it is not filtered rapidly through the kidneys as it would be in a "normal" person, and thus, builds up causing digitalis poisoning.

Finally, the technician should become familiar with Insulin and the symptoms of both Insulin Shock and Diabetic Coma, as Insulin is a major drug in the treatment of diabetes. Insulin as therapy is directed toward returning the carbohydrate metabolism as nearly as possible to normal.

Insulin shock is a condition of circulatory insufficiency resulting when the level of insulin in the body is too high. This can be caused by an overdose of Insulin, decreased or delayed food intake, after unusual physical exertion, and either an emotional or physical upset or change. Insulin shock requires an immediate need for some form of concentrated sugar, such as I.V. glucose, a piece of hard candy or a glass of orange juice with sugar mixed in.

Diabetic coma is the opposing condition where the level of insulin in the body is too low and the blood sugar is high. Treatment requires an immediate dose of insulin and I.V. fluids.

The technician should be aware of both situations, understanding the symptoms of an impending attack and the methods of treatment.

Symptoms of Diabetic Coma and Insulin Reaction[3]

Diabetic Coma	Insulin Reaction
Gradual onset	Sudden onset, begins abruptly
Skin hot and dry, face may be flushed	Perspiration, skin pale, cold, clammy
Deep labored breathing	Shallow breathing
Nausea	Hunger
Drowsiness and lethargy	Mental confusion, strange behaviour, nervousness

[3]Benjamin F. Miller, M.D. and Claire Brackman Keane, R.N., B.S., *Encyclopedia and Dictionary of Medicine and Nursing* (Philadelphia, 1972) p. 269.

Diabetic Coma	Insulin Reaction
Fruity odor to breath	Double vision
Loss of consciousness	Loss of consciousness, convulsions (rare)
Urine contains much sugar	May be sugar in urine
Blood sugar high	Blood sugar low

PSYCHOLOGICAL

The technician will always be faced with the patient who requires a lot of understanding and encouragement because of his treatable, but uncurable disease. The diabetic, particularly one with juvenile onset diabetes, will have been confronted with this information before, but the added complications associated with renal failure will present an additional psychological burden. Because each patient is unique the technician will have to modify his plan to each person. However, it is important to remember that the diabetic will be plagued by many, if not all, of the above mentioned problems, and it will be an important role of the technician to aid in the teaching of the patient and to help him further understand his part in controlling his disease.

From the above it can be seen why many diabetics have been refused treatment by hemodialysis. The added complications caused by the diabetic state make hemodialysis risky, if not almost hopeless. The technician will find that a great deal of the necessary care will fall upon him and he should be prepared to meet the patients needs.

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