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Renal Disease Treatment Procedure Under Various Stages of Disease

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ABSTRACT

This paper proposed in detail about the kidney disease treatment options for end-stage renal disease that is going to focus on treatment. When the kidneys fail the patient either call it end stage renal disease or in stage kidney disease, then patient have two options for being able to replace that kidney function or filter the blood something called dialysis. Dialysis is a term a way of artificially removing the waste and extra fluid from the blood, when patient kidneys can no longer do this. Here the author proposed specifically two major types of dialysis namely hemodialysis and peritoneal dialysis for treatment of patient who effected with the kidney diseases.

Keywords: CKD; hemodialysis; peritoneal dialysis; cycler; machine

I. Detail about dialysis treatments

In India renal disease increases significantly precisely in Uddanam, Andhra pradesh. The patients are suffering with the same diseases even after kidney transplantation. Patients are constantly visiting dialysis centers because of scarcity of kidney donors. Due to this patients are advised to go for different treatment technologies based on the severity of the individual renal disease. There are basically two renowned dialysis treatments which are Hemo dialysis and peritoneal dialysis another way of cleaning the blood.

The fig.1 which demonstrates the basic setup of hemodialysis [1-2].

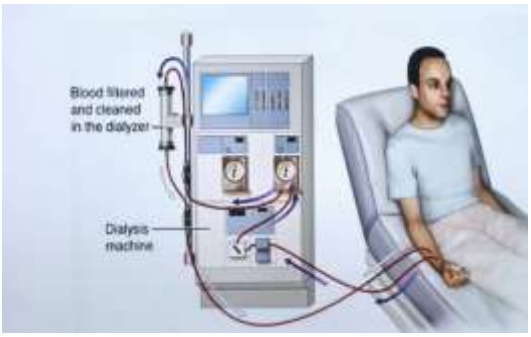

Fig.1 Basic setup of Hemodialysis

In the peritoneal dialysis we're not using a machine but more using the inner lining of our abdomen to clean the blood. Both types of dialysis though, require surgery for a dialysis access, so they do require some planning before we start with that. Now neither type of dialysis is better than the other, so it's really a matter of getting that information. And the principle is, there is some way of getting blood from the individual because patient kidneys were cleaning patient blood during the course of the day. Their overall cleaning about 180 to 200 liters worth of blood. During a dialysis treatment, Their is another way of getting the blood from an individual, and run it through a machine called an artificial kidney or a dialyzer. The cleaned blood then is returned back to the patients. So the way of being able to get that blood out of the individual into the machine by focus on the the hemodialysis access.

There are three major types and here going to discuss about the three types. There's the fistula which is a shunt that is created between our own artery in the patient own vein in which there's no artificial material in it. This procedure is performed by a vascular surgeon. It takes about six to twelve weeks before it's ready to be used. And the procedure itself is a same-day outpatient procedure and a lot of times it doesn't even need to be done under general anesthesia. The process starts by inception referred to the vascular surgeon having an evaluation. They might do an ultrasound of the veins in patient arm to figure out if the candidate for a fistula. Sometimes people have veins that are either too small or have been damaged over the years. From different other medical treatments and they don't have veins that could be used for a fistula. In those cases we use synthetic material which refer to as a graft. That would be the way of connecting that artery in the vein.

II. Time line details

Now the shunt because it's already the right size and it's already pre designed for this purpose only takes a couple of days. Two weeks before we need to use it. So a little less planning before patient need to get started on dialysis. The third category is the catheter and this is typically the one that we try to minimize the use. Because it's the highest risk of infection but it is the way patient can start dialysis on an urgent basis. If patient need to start at the same day this is a special IV line. That's all the larger size to be able to carry enough blood for the dialysis treatments. And it's done in radiology or in the operating room and it can be used. Now patient can see at the models of the hemodialysis access. Reviewing the first one is the fistula and the second one is the hemodialysis graft. Both of these are in this model. Here one of the key things to look at is that there's nothing outside of the body. And this is why it's really the lower risk of infection when we have a hemodialysis fistula or a graft. Once we get past the original surgery, when patient have the sutures won't be needing any bandages, any restrictions in terms of bathing showering swimming or any issues. What would happen during the diocese treatment is a nurse would put a tourniquet just like when they're drawing blood that would cause the vein of the fistula to pop up and then they would put a needle in during the treatment. Those needles would then stay in during the course of the treatment and then be removed at the end of the session. At the end of the session they would put some pressure on there for about 10 to 15 minutes and then you'd be having a bandage on there for about three to four hours after that you could remove the bandage and then just not need to have anything .

Now this lower part of the arm is what patient call a hemodialysis graft. Unlike when our veins in arm might be too small we sometimes put a piece of synthetic material tubing called a graft in to connect that artery in the vein. Same type of principle for the fistula. The Diocese nurses would put two needles in it during the course of the dialysis session. Ihey would remove those needles.Put some pressure on those points at the end of the treatment and then we have a bandage on there for about three to four hours. The benefits of this of course are the reduced risk of infection and the fact that we don't really have anything outside of our body during the dialysis session. So the third type of dialysis axis is the hemodialysis catheter. And this is the one that we can use . Part of this is this catheter has to be a larger size than any of the typical IVs that patient get in the hospital or the emergency room. And it needs to be a big enough size to have enough blood flow for the dialysis treatment. Because of that it's going to always go into one of the bigger blood vessels and the tip is typically going all the way to the level of the heart.Another challenge with these catheters are there's a large portion of it that's outside of the body so that's where that increased risk of infection is and so when we see at the catheter model, from this little blue piece here, that portion is always outside of the body just under the skin surface. Now when we have these catheters placed they're typically put in or tucked in underneath the collarbone. Now because so much is outside of the body there is the risk of infection.

So patients are really careful about not getting these wet, showering and or bathing we really can't get this catheter wet, really cannot be swimming and the dressings are changed by the nurses whenever patient come for in for dialysis treatment. Now these catheters have two ports to them during the treatment. The nurses would remove the caps and hook them up to the lines for the dialysis treatment itself. At the end of the treatment they would unhook the lines and then just put new caps on them and that's how the catheter would stay until our next dialysis session. Regarding hemodialysis, there are two different types such as Center hemodialysis and home hemodialysis. So in Center it's performed in a dialysis unit by medical staff. It's happening three days a week and often for about three to four hours. So when it's three days a week we're either going on a Monday,Wednesday,Friday schedule or a Tuesday,Thursday, Saturday schedule.

III. Machine and human interface

There's no training involved because this treatment is taken care of by the staff there. Now when patient come in for treatment be weighed before and at the end of the each treatment. That's how the staff figures out how much fluid to take off with each session. They will be checking the blood pressure, the heart rate and the temperature before the treatment and then every fifteen to thirty minutes during the course of the session blood work is often checked. During those treatments we're not having to be going to the lab on a separate basis. Also certain medications that patient had been taking beforehand are either going to be replaced by the actual dialysis treatment or they're going to be given during the dialysis session. So a lot of times our medication list is changing. Because as we're going to the dialysis unit three times a week we're going to be seeing our kidney doctor there at the dialysis unit instead of going to their office . So patient have to plan ahead if we need to be rescheduling for another doctor's appointment or from going out of town. And it's a little more of a restricted diet. Remember when our kidneys were doing the work they were doing the work seven days a week. Now going to try to compress in two treatments that are happening just three times a week.

Now in home hemodialysis, are using the same type of dialysis access that we are using for in Center. it's a different machine. In this treatment is going to be performed at home by the patient and a partner. The sessions are happening about four to six days a week and each sessions about two to three hours training typically takes about four to eight weeks. But if you need a little bit longer time no one is going to be releasing that machine to us or expecting us to do that earlier than ready to during the training, learn about weighing ourself, checking our blood pressure, our heart rate how to access our hemodialysis catheter or fistula and how to draw our labs and how to set up and take down the machine. Now require that the partner would be there while doing our treatments. Patient will still be coming to the clinic to follow up with the dialysis. Nurse and the doctor about one to two times a month the downsides of the home hemodialysis treatments are that we do need to have a partner at home. So this might be a limiting factor for some people being able to choose. This as an option additionally we need a lot of space at home for all of the supplies. There's shipped out on a monthly basis. So if you're not in a stable home situation this may not be the best option for us and we're going to take a look at the home hemodialysis machine. So this is a model of our home hemodialysis machine [5] and we can see it's pretty self-contained shown in Fig.2.

Fig.2 Home hemodialysis machine

The front of it is a pretty user friendly touch screen button. So it's easy to be able to monitor the different steps and be able to pull off the information that we need. This is a considered medical life-saving equipment and so when we're traveling they have to make accommodations. And all of our other supplies can be shipped to our destination .There isn't any specialized changes that we're going to need to make in our house. Patient do make some checks for our home safety. It will be appropriate for the electrical outlet and things along that line. This equipment is not owned by us. It is owned by the dialysis company and so therefore we don't have to worry about the maintenance. If there are issues with the machine, the company will switch out the machine for us and the key parts of it are very user-friendly and just simple things of being able to pull a lever pop in a cartridge and a very easy user-friendly touchscreen.

The other type of home dialysis is peritoneal dialysis and this one takes advantage of the fact that all have a thin layer or membrane on the inside of our abdomen which can work as a filter to clean our blood and we use a fluid that gets piped into the abdomen and sits in there and pulls out all of the waste products .This treatment only takes place at home and also requires training.Now there are two different types of peritoneal dialysis and an individual when they're trained is trained on both options. There's the manual exchanges which don't require any specialized equipment or electricity. And a cycler which about 90 percent of those individuals who are on peritoneal dialysis are using now. Fig.3 shows the types of Peritoneal dialysis [3-4].

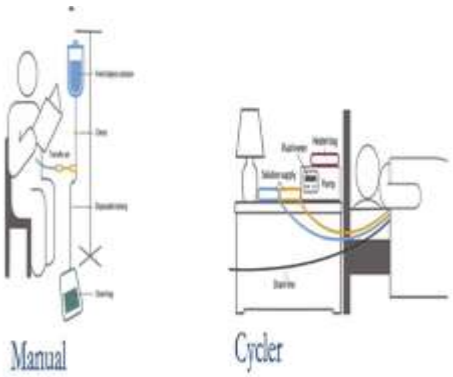

Fig.3 Types of Peritoneal dialysis

A peritoneal dialysis catheter and when patient see about a hemodialysis access that required a lot more planning. The peritoneal dialysis catheters only need to be placed about one month before patient need to start the treatments .It takes about two to four weeks to heal before the nurses can start flushing the catheter and doing some of the exchanges. And then about four weeks after the placement of the PD catheter fully use the catheter and start doing some of the training and the Fig.4 below shows the image of a Peritoneal dialysis catheter[6-8].

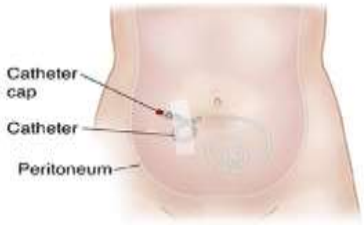

Fig.4 Peritoneal dialysis catheter

Someone with a peritoneal catheter and the model that will be showing as well. So this is our model of a peritoneal dialysis catheter as can see it's in the lower abdomen. About 90% of our catheters are in the lower abdomen. Sometimes they are put in the chest because of different considerations. But most of the time they are in the lower abdomen as can see if there's a portion of tubing that's outside of the body. Now this is the portion that will always be outside.Usually people have this coiled up underneath a gauze or a belt. So it's not getting in the way or getting caught on their clothing.

The catheter itself is anchored just underneath the skin surface in two different places and the rest of the catheter is coiled freely floating in the abdomen. When patient are doing our exchanges we would be unrolling this and hooking it up to the different ports. Take the cap off and hook it up to the tubing. Because this catheter is in the lower abdomen and can see where it is on the body , to be careful if soaking. Really can't be soaking in a tub, can't be taking tub baths or hot tub saltwater so these are all considerations in our lifestyle when making a decision about doing peritoneal dialysis. The peritoneal dialysis works it starts off with a special fluid called dialysate. that fluid is put into the abdomen through that catheter. It sits in the abdomen for a certain amount of time. It either will be sitting there from about four to six hours depending on someone's body size and the nature of their hair Tennille membrane. It's pulling all the waste products out. It's pulling all that extra fluid that all gets drained out after about four to six hours and new fluid is instilled in. So while the fluid is sitting in the abdomen, it's pulling out all of those waste products that's pulling out extra water and all of the chemicals and this dialysate. Because it doesn't contain any blood will then be able to be poured down the drain or in the toilet and discarded. So peritoneal dialysis is performed only at home. There's not a requirement for a partner because there's no direct access to blood. So there's less risk of any emergency procedures. The training itself takes about two to six weeks. During the training will learn how to check our weight, our blood pressure and how to determine which of those dialysate fluids to be using.

Doing the exchanges either doing manual exchanges about three to four times a day depending on our body size or doing something where using a machine called a cycler where that's going to do the exchanges during the course of the night. Sometimes people will be doing a combination of both. It's really going to be individualized based on what our body needs. There are some downsides to the peritoneal dialysis. Do need space at home getting those shipment of materials about once a month. So if not in a stable home situation, it's harder to be able to do this treatment.

The other thing is that the dial safe fluid has a high amount of sugar in it and so sometimes it can be more difficult to control our diabetes. In Fig.5 it's showing to demonstrate how someone is connecting between the different dialysate bags and doing the connections along with the working of peritoneal dialysis. And we're going to show the model that will show the manual exchange and the cycler. So for peritoneal dialysis it's done in two different ways.

Fig.5 Working of Peritoneal dialysis

There's exchanges at night time but the manual gives us that opportunity if patient travelling for one night or if there's a power outage we still have a way of doing these treatments .Sometimes people might need to do both. Now the manual exchanges all work basically with gravity. So if this peritoneal fluid in there already the dialysate fluent in when time to do our exchange would take our catheter remove the cap hook up to the line to admit this bag would be on the floor. Because the bag is going to be draining to gravity. the fluid that's sitting in our abdomen would then drain into this bag. Fill the bag and then once that bag had finished training would open up the next larger. The new fluid bag and then drain that fluid in and then leave that in for about four to six hours would go through that process. The actual process itself between draining the old fluid and then putting the new fluid in should take about 30 minutes. If it takes a little bit longer then might do some troubleshooting.

For many people they are using the cycler and the cycler is a machine that at night time they would be hooking up to about 10:00 p.m. at night and stopping the treatments maybe about 6:00 in the morning. The cycler is designed to have all of the connections already made with all the bags of fluid so that the machine would be doing all of those exchanges. It also has a touch screen to it and then it would allow us to know what it's draining, how much it's drained and then the next bag of fluid that it's instilling the lines for this cycler are a little bit longer. So we do have the ability to get out of bed, don't necessarily have to disconnect from the machine.Fig.6 shows the image of the cycler [9].

Fig.6 Cycler

Now typically if somebody is using the cycler they're running their treat through the course of the night. At the end of the night they would disconnect from the machine depending on their body size and what their prescription is. They might do a manual exchange and carry that on through the day or they might not have any fluid and not have to do anything until later that evening when they would hook up to the cycler again. If somebody has had a lot of abdominal surgeries they may have developed a lot of scar tissue in their abdominal wall and that would prevent them from being able to filter the blood appropriately. If they've had an issue where they have a VP shunt where they've built up fluid on the brain and they have a VP shunt that could get infected if they're on peritoneal dialysis. If they've had an abdominal cancer there's always a risk that they could be spreading some of those cancer cells. So patient don't typically allow individuals to do peritoneal dialysis in those settings. And the last category is somebody has liver disease where they already are building up a lot of fluid called ascites. They may not tolerate having more fluid in their abdomen for the peritoneal dialysis. So how do we choose which type of dialysis is the best one for us, pick which one suits our lifestyle and transition from one type of dialysis to the other. Neither type of dialysis is better than the other. Both types have good outcomes. It's more important to find the one that we're more comfortable with. And that's going to fit our lifestyle because then going to have better results.

IV. Conclusion

The article proposed across the kidney disease treatment under various view of stages of patient. Mainly focus on two very important dialysis which are hemodialysis and peritoneal. And withal this article which provides info about the human and machine interface and elegant layout of kidney disease treatments.

V. Reference

[1] Himmelfarb, Jonathan, and T. Alp Ikizler. "Hemodialysis." *New England Journal of Medicine* 363, no. 19 (2010): 1833-1845.

[2] Held, Philip J., Friedrich K. Port, Robert A. Wolfe, David C. Stannard, Caitlin E. Carroll, John T. Daugirdas, Wendy E. Bloembergen, Joel W. Greer, and Raymond M. Hakim. "The dose of hemodialysis and patient mortality." *Kidney international* 50, no. 2 (1996): 550-556.

[3] Gokal, R., and N. P. Mallick. "Peritoneal dialysis." *The Lancet* 353.9155 (1999): 823-828.

[4] Popovich, Robert P., et al. "Continuous ambulatory peritoneal dialysis." *Annals of Internal Medicine* 88.4 (1978): 449-456.

[5] Agroyannis, B., et al. "Telemedicine technology and applications for home hemodialysis." *The International journal of artificial organs* 22.10 (1999): 679-683.

[6] Peppelenbosch, Arnoud, et al. "Peritoneal dialysis catheter placement technique and complications." *NDT plus* 1.suppl_4 (2008): iv23-iv28.

[7] Crabtree, John H., and Kai-Ming Chow. "Peritoneal dialysis catheter insertion." *Seminars in nephrology*. Vol. 37. No. 1. WB Saunders, 2017.

[8] Choi, Peter, et al. "Peritoneal dialysis catheter removal for acute peritonitis: a retrospective analysis of factors associated with catheter removal and prolonged postoperative hospitalization." *American journal of kidney diseases* 43.1 (2004): 103-111.

[9] Wheeler, E. K., et al. "Convectively driven polymerase chain reaction thermal cycler." *Analytical Chemistry* 76.14 (2004): 4011-4016.