



The History of Hemodialysis

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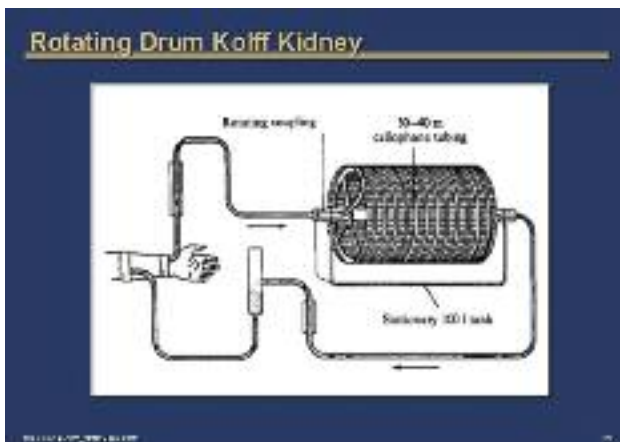
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In this section we review some of the efforts, beginning more than 100 years ago, that led to the development of modern hemodialysis.

Early efforts

In 1861, Scottish chemist Thomas Graham experimented with a vegetable paper coated with a protein called albumin. Using this simple membrane Graham discovered how particles were able to move across a membrane (the process of diffusion). Through his research he found that he was able to remove urea from urine.

In 1913, Drs. John Abel, Leonard Rowntree, and B.B. Turner created the first artificial kidney. They used celloidin tubes held in a glass “jacket.” The jacket was filled with saline or artificial serum. They also used a primitive anticoagulant called hirudin, found in the blood of leeches. Although this device was revolutionary it was never used on humans.



The development of practical hemodialysis

The first documented hemodialysis treatment was done in 1924 by George Haas in Germany. The treatment lasted 15 minutes and went without complications.

The first practical hemodialysis machine for use by people was developed by Dr. W.J. Kolff in the Netherlands in 1943. It resembled a steel drum. Cellophane sausage casing was wound around the drum while the lower portion of the drum was suspended in a dialysis bath. This procedure needed



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a large amount of blood and the patient required many blood transfusions to make it work.

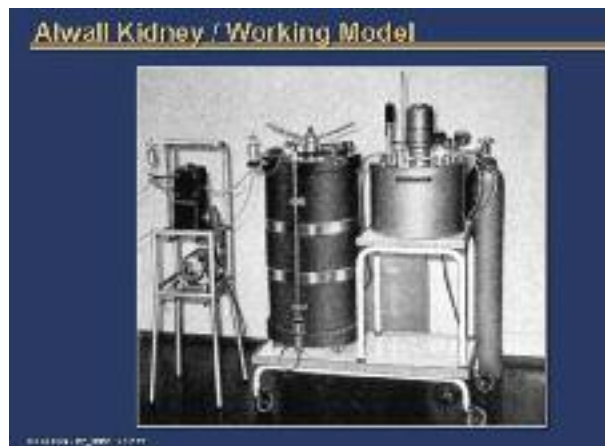
In 1947 in Sweden, Dr. Nils Alwall developed a creative machine called the Alwall kidney. The machine was comprised of a barrel placed in a stainless steel canister. This enabled positive pressure to be applied so fluid could be removed.

The beginning of chronic hemodialysis

In the early 1960's hemodialysis was a procedure that would last 8–10 hours, every other day. Dialysis treatments were confined to patients with acute kidney disease (reversible kidney failure) only because a patient's veins could only be used for 7–10 treatments. As a result, dialysis was only available to a limited number of people and restricted to just a few centres. Early dialysis machines were also large and cumbersome and required a large amount of space. The dialysis 'membranes' were reusable plates that had to be rebuilt for each treatment.

In 1960, with the creation of a reusable vascular access called the Scribner shunt, dialysis treatments would change forever.

Designed by Dr. Belding Scribner of Seattle Washington, the Scribner shunt used a U-shaped teflon tube that routed blood from an artery back to a vein. The shunt protruded out from the skin and would then attach to the blood tubing. When the shunt was not in use, caps were placed over the tubing. With this new shunt, chronic kidney failure patients now had access to hemodialysis.



Dr. Scribner also contributed to the development of home hemodialysis with the creation of portable dialysis machines that could be operated by the family members of a patient.



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In 1964 with the death of a young Montreal architect, The Kidney Disease Foundation of Canada was formed to advocate for kidney patients.

Medicare and the issue of access to hemodialysis

With the development of the Scribner shunt and other vascular access breakthroughs, regular chronic hemodialysis became possible. However, because of the expense of the treatment doctors and government officials now faced an ethical dilemma over who should be allowed hemodialysis and who shouldn't.

In Canada, only a few hospitals could support this expensive treatment so hemodialysis was strictly rationed and selection committees were formed to determine who would receive the life-saving therapy.

In 1966 the Medical Care Act (Medicare) was passed by the Canadian federal government. With the passage of this act the cost of treatment for kidney disease was covered, providing access to dialysis for many kidney patients.

Mainstream dialysis

Through the 1970s and '80s dialysis technology continued to improve rapidly. Dialysis machines were developed with more reliable **ultrafiltration control** (fluid removal) and more efficient dialyzers (dialysis membranes) were produced.

The development of erythropoietin (EPO)

In the 1970s, Drs. John Adamson and Joseph Eschbach in Seattle researched kidney failure and the role of hormones in the production of red blood cells. This work led to their discovery of erythropoietin. Erythropoietin is a hormone normally produced in the kidneys and stimulates red blood cell production. When a person develops kidney disease production of this hormone slows down or stops completely. Before development of a recombinant form of EPO, most dialysis patients required up to two blood transfusions a month to ensure they maintained an adequate supply of red blood cells.

The advancement of DNA gene mapping in the 1980s made possible the development of a synthetic form of EPO. By 1989 this discovery had almost completely eliminated the need for blood transfusions for kidney patients.

The start of nocturnal hemodialysis

Over this decade, most dialysis treatments continued in the conventional way. However, in 1993 in Toronto, Dr. Robert Uldall, and Dr. Andreas Pierratos began home dialysis treatments for patients, enabling more frequent treatments and the ability to have hemodialysis through the night.



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The success of these treatments demonstrated that by increasing length of time on dialysis and its frequency, negative outcomes from dialysis were reduced and lifestyle outcomes were improved.

Today

A number of centres around the world – including our own – are now using the technique called nocturnal hemodialysis (NHD).

The BC Provincial Renal Agency's Home Hemodialysis Program was started in September 2004. At right is an example of the current generation of dialysis machines for home hemodialysis used by our patients.

