Improvements on Kidney Dialysis Treatment

Alaa Ahmed (CHE), Dana Khawaja (CVE), Heba Al-Johar (CHE), Roba Saab (MCE)

Current situation

Millions of people die every year due to kidney failure, therefore kidney dialysis has become one of the most important biomedical engineering issues.

Research Question:

What are the latest technological improvements used to enhance kidney dialysis machines, and how can we improve the efficiency and quality of the treatment?

Problems of the Conventional Dialysis

- Conventional kidney dialysis is time consuming and expensive
- Patients are required to spend 12-15 hours every week connected to the machine as shown in Figure 1
- Some patients skip their treatment sessions out of frustration [2]
- Poor and inefficient use of the conventional kidney dialysis
- Improving the dialysis process is of crucial need for medical technology

References:


Solution A: Automated Wearable Artificial Kidney (AWAK)

- “Patients will no longer have to endure the 12-15 hours in hospitals for traditional dialysis” [2]
- Device is portable, patients are free to do any normal activity
- Worn around the upper body like a coat or like a belt on the waist as shown in Figure 2
- Equipped with monitoring system screen to monitor blood and dialysate flow
- Patients will not feel nausea and tiredness after sessions
- Patients do not have to regularly replace the dialysate
- Avoids complications associated with traditional dialysis machines, patients will not be at risk of infection

Solution B: Peritoneal Dialysis

- Continuous Ambulatory Peritoneal Dialysis
  - No machine required as shown in Figure 3
  - Not time dependent
  - 4 to 5 sessions a day, 4 hours between sessions
- Continuous Cycler-assisted Peritoneal Dialysis
  - Automated cycler required
  - Treatment could be during patient’s sleep
  - One session, 8 hours long
- “The patient doesn't have to stay at a dialysis clinic several hours a day, three times a week[...] and the process is not painful” [3]