Chapter 1

Introductory Chapter

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Additional information is available at the end of the chapter

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Conventional hemodialysis (CHD) treatment is a basic renal replacement therapy (RRT) that has been serving and supporting the life of patients with end-stage renal disease (ESRD) for many years. The capabilities of this modality, which is based on the physiologic principle of diffusion, are however limited. In reality, CHD can remove excess fluids but with some difficulty in maintaining hemodynamic stability and can only clear small-size uremic toxins of less than 500 Da such as urea and creatinine but not larger-size uremic toxins of more than 500 Da. These include middle molecules such as β2-microglobulin and protein-bound molecules such as indoxyl sulfate and *p*-cresol, where their accumulation in the blood can lead to hemodialysis-related amyloidosis and endothelial inflammation and toxicity, respectively. This may explain, at least in part, the high incidence of morbidity and mortality in patients treated with CHD. Furthermore, the intradialytic complications and post-dialysis tiredness, fatigue, and exhaustion have negatively influenced the quality of life of dialysis patients.

The recent technical advances in dialysis machine specifications, production of ultrapure water by modern water treatment system, innovation of synthetic biocompatible high-cut-off membranes, achievement of scientific knowledge in implementing the other physiologic principle of convection, and combining diffusion with convection have all revolutionized the dialysis technique. For example, the modality of hemofiltration (HF), which is based on convection, is capable of removing larger-size molecules of more than 500 Da, whereas the modality of hemodiafiltration (HDF), which combines diffusion and convection, is capable of removing small- and larger-size uremic toxins. In addition, both of these techniques provide more hemodynamic stability, which is more evident with online HDF. Over many years, multiple observational and randomized clinical trials showed plenty of clinical benefits of online HDF, which had significant impact on morbidity and mortality rates. Since the establishment and implementation of online HDF, a significant experience and knowledge have been gained in ways of its application and achievement of beneficial clinical results (**Figure 1**).

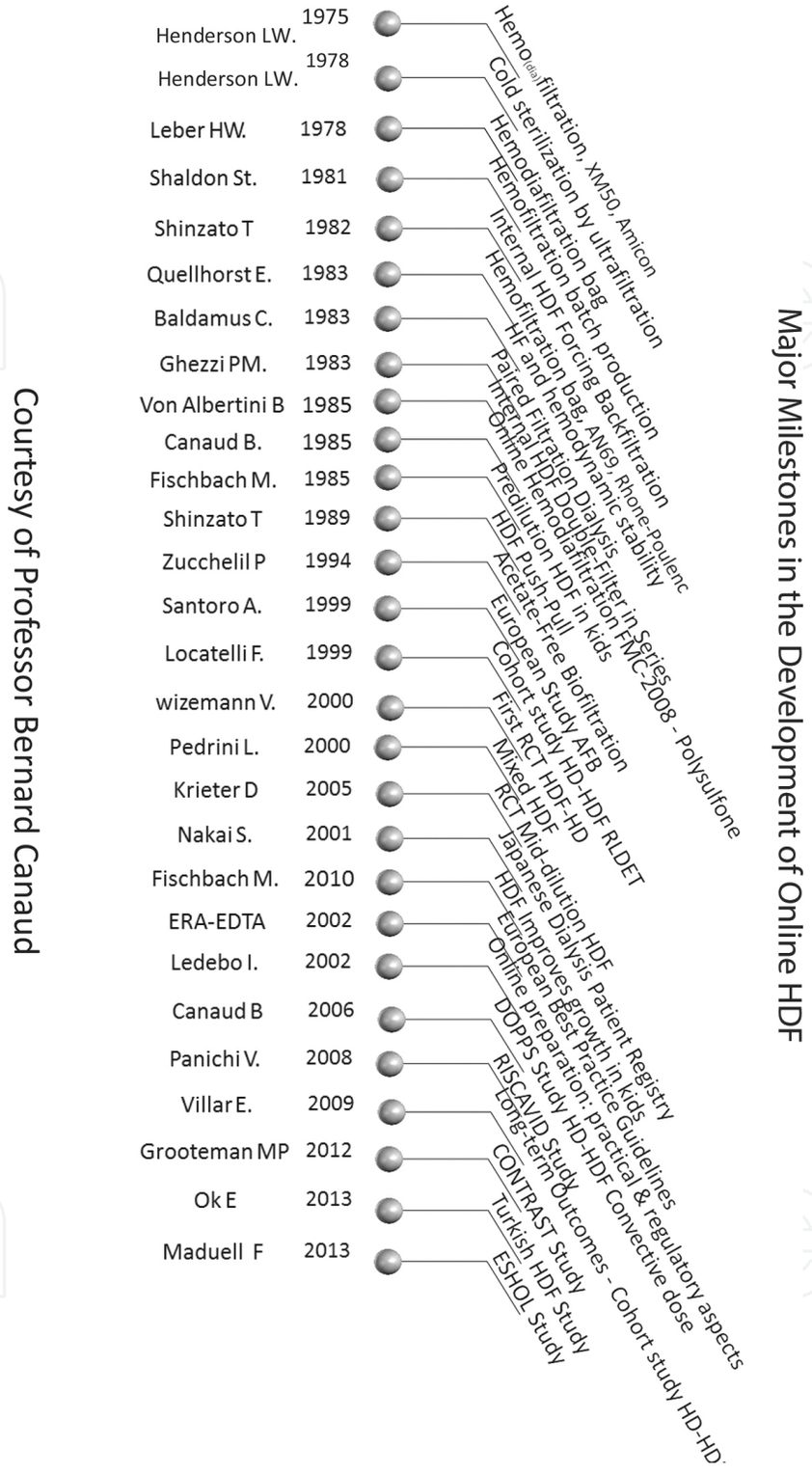

Figure 1. Major milestones in the development of online HDF.

The *Advances in Hemodiafiltration* book has been specifically designed to describe and demonstrate the treatment modality of HDF from its basic concepts to the most recent advances in the techniques of its implementation. Under specific titles of specially created chapters, this

book covers principles of HDF, generation of ultrapure water, fluid convection and reinfusion, factors affecting convective dose, dialysis machine-dependent technical factors, prescription of HDF, performance and effectiveness of HDF, clinical benefits including results of major randomized clinical trials, effects of online HDF on arterial stiffness and heart failure, quality of life of patients on HDF, cost-effectiveness of HDF, and applicability of HDF at home.

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