Austin Journal of Nursing & Health Care

Open Access

Austin Publishing Group

Review Article

The Effect of Dialysate Flow Rate on Dialysis Efficiency

Sahar Essa Alramadhan[1]*, Nouf Idres mohd[2], Abeer mohammed alqassmi[3], Bander Justinia[4], Suliman Ali Amri[5], Abdur Rakib Talukder[6], Mohd Eid Ayad Alharbi[7], Abdulrahman Rashed Alanazi[8], Bashair Aldajani[9]

[1]Senior Specialist, King Saud Medical City, Riyadh.

[2]Dialysis Nurse, King Salman Hospital, Riyadh

[3]Nurse, king Salman Hospital, Riyadh

[4]MSC Nursing Leadership, DON in King Fahad Kidney Center, KSMC, Riyadh

[5]MSC Nursing leadership, HN in King Fahad Kidney Center, KSMC, Riyadh

[6]Registrar, Degree: MRCS(Edinburgh), Security Force Hospita Degree: MRCS(Edinburgh), KSA, Riyadh

[7]Nurse Technician, Almurabba Primary Health Centre, Riyadh

[8]Healthcare Administration specialist, Albijadih General hospital, Riyadh

[9]Senior Specialist, Dawadmi General Hospital, Riyadh

***Corresponding author:** **Sahar Essa Alramadhan**
Senior Specialist, King Saud Medical City, Riyadh

Received: December 07, 2022; **Accepted:** January 11, 2023; **Published:** January 17, 2023

Abstract

End-stage renal failure is a debilitating condition with a high level of mortality. One of the most effective approaches for ameliorating these conditions is hemodialysis. It saves hundreds of thousands of patients every year from premature death. Increasing dialysis efficiency is a core proponent of hemodialysis. Accordingly, an increase in dialysis efficiency means that hemodialysis is improved. A number of approaches have been taunted as effective in improving dialysis efficiency. One of these approaches is increasing the dialysate flow rate. The research, however, on the effect of dialysis flow rate on dialysis efficiency is not conclusive because some studies suggest that an increase in dialysis flow rate increases dialysis efficiency, while other researches point out that an increase in Qd has minimal to no impact on dialysis efficiency.

Keywords: Dialysate flow rate; Dialysis efficiency; Hemodialysis; Dialysis adequacy; Urea reduction ratio

Introduction

Patients with end-stage renal failure require dialysis and an assortment of other medical interventions to avert mortality and improve their quality of life [4]. The kidneys of a patient with end-stage renal failure are dysfunctional and cannot rid the blood of uremic toxins [4]. Thus, the goal of dialysis is to efficiently clean the blood of the said patient of pertinent uremic toxins, including salt and fluid overload. Further, renal failure patients commonly have other metabolic disorders, including oxidative stress, mineral bone disease, and anemia, which need to be addressed during dialysis treatment. In many parts of the world, hundreds of thousands of patients currently benefit from dialysis programs; without these programs, the lives of these patients would end prematurely [4,5]. A common metric of dialysis is the dialysate flow rate; this metric will form the basis of the following work. The effect of dialysate flow rate on dialysis efficiency is not conclusively known because currently, some research underline that an increase in dialysate flow rate leads to an improvement of dialysis flow rate, while others underline that this has a slight to no impact on dialysis adequacy.

Background

As a patient with chronic kidney failure progresses to end-stage kidney disease, they usually develop uremic syndrome. A number of extracorporeal therapies may be deployed to help improve the quality of life of the patient and avert premature death. One of these therapies is hemodialysis. The therapy is largely mechanical; uremic toxins are removed from the blood. Further hemodialysis maintains electrolyte and fluid levels and corrects acid-base disturbances [8]. A common proponent of hemodialysis is dialysis efficiency. Dialysis efficiency is essentially a review of how well a dialysis regimen works. Dialysis efficiency is sometimes referred to as dialysis adequacy. In instances where the dialysis adequacy is high, the dialysis is working; the patients will usually experience an improvement in their symptoms [6]. Two of the commonest approaches to

Citation: Alramadhan SE, Mohd NI, Alqassmi AM, Justinia B, Amri SA, et al. The Effect of Dialysate Flow Rate on Dialysis Efficiency. Austin J Nurs Health Care. 2023; 10(1): 1076.

measuring dialysis efficiency/ how well the patient's dialysis is going are Kt/V and the urea reduction ratio. Kt/V calculates the amount of the patient's body fluid that has been cleared of urea during a particular dialysis session. K is the urea clearance which is commonly obtained by sensors on the machines using machine conductivity probes. To obtain Kt, the urea clearance K is multiplied by the duration of the hemodialysis session. V, on the other hand, is the volume of water that the patient's body contains. The urea reduction ratio essentially measures the amount of urea in the patient body before and after dialysis and then compares the two to determine dialysis efficiency [7]. The formula for calculating the Urea Reduction Ratio (URR) is 100 x (1- [C_t/C_o] where C_t is the blood patient blood urea five minutes after a dialysis session while C_o is the patient's urea nitrogen before the dialysis session. The other approach through which dialysis efficiency is determined is via the mass transfer area coefficient (KoA). A Kt/V of about 1.2 and urea reduction ration of 65 percent is optimal. A majority of hemodialysis are able to monitor these via machines automatically. Dialysate flow rate (Qd) of 500ml/min has previously been recommended. However, research current recommends that the Qd be increased to 800ml/min to improve dialysis efficiency. To this end, some researches show that an increased Qd does not lead to Kt/V or KoA [1]. Further, a few researches show that an increase in dialysate flow rate was directly proportionate to an increase in dialysis efficiency.

Discussion

In [1], it was shown that increasing dialysate flow rates had very little impact on dialysis efficiency. In this study, these authors aimed to find the effect dialysis flow rates of 500 and 400 ml/min had on Kt/V, interdialytic gain, potassium hemoglobin and phosphate. The research conducted by these authors was essentially an in vivo comparative trial between 500 and 400 ml/min with polynephron membrane conducted three times a week with four hours of dialysis session. Further the respondents were 70 Kgs and the research lasted for over a period of five years. According to these authors, an increase in dialysate flow rate from 400 ml/minute to 500 ml/minute had little to no impact of the dialysis efficiency. These results are further mirrored by [3]. In their research study, these authors aimed to study the impact of dialysate flow rates 500ml/minute and 800ml/minute. These authors made use of a prospective randomized cross over study. About 630 dialysis sessions were observed in the research study. Different Kt/V was used in the research to determine the dialysis adequacy/efficiency. Accordingly, these authors made use of the single pool Kt/V, the online clearance monitoring Kt/V and the equilibrated Kt/V. The results obtained by these authors indicated that increasing Qd from 500 to 800 ml/minute occasioned a slight to no increase the dialysis efficiency.

In [2], on the other hand, it was shown that an increase in dialysis flow rate led to improved dialysis efficiency. The objective of this research was to review the effect of two dialysate flow rate of 500ml/minute and 650ml/minute had on hemodialysis efficiency. In the research, these authors made use of case control analysis in which the control group utilized a dialysis flow rate of 500ml/minute while the intervention group was put on a dialysis flow rate of 650ml/minute. The research design was essentially a quasi-experiment in which the hemodialysis adequacy, i.e., the Kt/V, was measured twice. One hundred fifteen study respondents participated in the research in which a total of 230 dialysis sessions were observed. The results indicated that an increase in dialysis flow rate led to improved dialysis adequacy. Overall, analysis indicates that while some research recommends Qd to augment dialysis efficiency [2] other studies are of a contrary opinion [1,3]. Effectively, more irrefutable research is required.

Conclusion

To sum up, the impact on dialysate flow rate is not conclusively known. Currently, a number of researchers believe that increasing Qd leads to an improvement in dialysis efficiency. There are others researches, on the other hand, which underpin that an increase in dialysate flow rate has little to no impact on dialysis efficiency. Hemodialysis has had a preponderant impact on patients with end-stage renal disease. Worldwide, hundreds of thousands of end-stage renal disease patients are treated with dialysis every year, thus averting premature death. Kt/V and URR usually measure dialysis efficiency. The other metric used to determine dialysis adequacy was KoA. This research showed that the effects of Qd are not conclusively known since researchers underline contrary views on the consequence of increasing it on dialysis efficiency. Ultimately, there is a need to undertake future researches on this subject.

References

1. Molano-Triviño A, Guzmán G, Galván Á, Ducuara D, Martínez A, Yúnez A. Dialysate flow: Is the less the better? Blood Purification. 2019; 49: 121–2.

2. Ginting L, Permatasari A, Yasmine E, Koerniawan D. Comparison of outcomes of hemodialysis adequacy with dialysate flow rate of 500 ml/minute and 650 ml/minute. The Avicenna Medical Journal. 2021; 2: 1–6.

3. Srisuwan W, Charoensri S, Jantarakana K, Chanchairujira T. Increasing dialysate flow rate over 500 ml/min for reused high-flux dialyzers do not increase delivered dialysis dose: A prospective randomized cross over study. Siriraj Medical Journal. 2022; 74: 152–60.

4. Schaier M, Leick A, Uhlmann L, Kälble F, Morath C, Eckstein V, et al. End-stage renal disease, dialysis, kidney transplantation and their impact on CD4+T-cell differentiation. Immunology. 2018; 155: 211–24.

5. Wang C, Naylor KL, Luo B, Bota SE, Dixon SN, Yohanna S, et al. Using administrative health care databases to identify patients with end-stage kidney disease with no recorded contraindication to receiving a kidney transplant. Canadian Journal of Kidney Health and Disease. 2022; 9: 205435812211117.

6. Jones CB, Bargman JM. Should we look beyond Kt/V urea in assessing dialysis adequacy? Seminars in Dialysis. 2018; 31: 420–9.

7. Liang KV, Zhang JH, Palevsky PM. Urea reduction ratio may be a simpler approach for measurement of adequacy of intermittent hemodialysis in Acute Kidney Injury. BMC Nephrology. 2019; 20: 82.

8. Reddi AS. Hemodialysis. In *Absolute nephrology review. 2022:* 465-515). Springer.