Original article

Adverse effects of hemodialysis on kidney patients: how good the evidence is

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Abstract

Objective: Hemodialysis is a treatment for End Stage Renal Disease (ESRD) patients. The incidence of ESRD has been increased up to 8% from 2004 to 2011. Based on some studies, various complications can occur in hemodialysis process. This study was conducted with the aim of investigating the incidence of adverse side-effects during hemodialysis in kidney patients.

Methods: This descriptive-analytical study was done in 2015 (05 Feb to 12 April) on 142 patients under hemodialysis treatment. Data gathering was done by using a researcher-made checklist which was designed by studying authoritative sources. Data analysis was done by SPSS. V.16 using ANOVA and Chi-square tests.

Results: Among 142 patients, 51.38% were female and 48.62 of them were male. Muscle cramp (72.53%) and Bleeding (2.11%) were the most and the least complications that have been attested during hemodialysis respectively.

Conclusion: According to the various side-effects of hemodialysis process in this study, some actions such as reducing the pump rotation and nutrition education is recommended in order to increase the level of satisfaction in patients.

Keywords: *Hemodialysis, Patients, Complication, Health promotion; kidney.*

Introduction

Hemodialysis is a treatment for End Stage Renal Disease (ESRD) patients, in which blood comes out from the body and its chemical composition is changed by releasing blood in semi-permeable membranes to remove waste materials and then it is back to the body (1). In this process in addition to removing waste materials, some necessary products are added to the blood (2). Most patients require 9-12 hours of dialysis during the week, which is divided into several sessions. Unpleasant side-effects of hemodialysis such as hypotension, muscle cramps, nausea and vomiting could happen during the process (3). Incidence of ESRD has been increased up to 8% during 2004-2011 time span (4). In the United States more than 280 thousand patients with chronic renal failure are under dialysis (65%), more than 120 thousand people have implanted kidneys (28%) and more than 24 thousand people use peritoneal dialysis (5).

Hemodialysis is the most common process of kidney replacement therapy (6). According to statistics, there are about 24000 patients undergoing dialysis in Iran and 12% (4.5 million) are added to this patients annually (7). Based on

some studies recorded complications of hemodialysis include hypotension (20-30%), muscle cramps (5-20%), nausea (5-20%), headache (5%), chest pain (2.5%), back pain (2-15%) and fever (21%) (8,9). Studies also show that 5-20% of hemodialysed patients experience painful involuntary muscle contractions, more than 10% of which experience nausea and vomiting and 10-15% of them experience hypotension (10).

Considering the problems of these patients and differences among reported side-effects by various researchers, this study was conducted with the aim of investigating the adverse side-effects during hemodialysis in kidney patients.

Method

This descriptive-analytical study was done in 2015 (05 Feb to 12 April) in which 142 hemodialysed of Bu-Ali Sina hospital were investigated by using Census method. The inclusion criteria were as follows: being an ESRD patient, being a permanent patient of the hemodialysis section and also doing hemodialysis at least twice a week. Exclusion criteria included every unpleasant incident that made patients avoid to be studied. The study was confirmed in the ethics committee of Mazandaran University of Medical Sciences. Data gathering was done using a researcher-made checklist which was designed by studying authoritative sources (8). The content validity of this checklist was confirmed by a detailed survey of 10 experts and by doing necessary modifications. Each patient was investigated in 3 hemodialysis sessions. In the first session, the purpose of the study was described to each of them and they filled the consent form. Before beginning the study, a brief history of each patient was prepared. Blood pressure (BP) and weight of the patients were measured before the treatment. All patients were under dialysis using bicarbonate solution; also dialysis speed was recorded in the beginning of the experiment and BP was recorded 4 times during dialysis. If complications were observed, they were recorded by the investigator. At the end of each dialysis session, BP and weight were recorded again. In the last session, before and after dialysis, blood samples were sent to the laboratory for assessment.

Data analysis

The data were analysed by SPSS 16. Basic descriptive for quantitative variables was presented using mean (SD) and n (%) for qualitative variables. Chi-square and ANOVA were used to assess associations between demographic and independent variables; Significant level was considered $P<0.05$.

Results

Among 142 studied patients, 51.38% of them were female and 48.62% were male. Among participants, 100 patients were under hemodialysis 3 times a week and others were under hemodialysis 2 times a week. Some of the studied indicators are presented in table 1.

Among all patients, 31 of them (21.83%) had no complications that 19 of them were male and 12 ones were female.

In this study, various complications such as seizures, vomiting, hemolysis, thrombosis, air embolism, hypoglycemia, imbalance syndrome and heavy water syndrome were not seen. 48 patients (33.80%) were under treatment in the morning shift, 62 patients (43.66%) in the evening shift and the other 32 patients were treated in the night shift. In table 3 the frequency of side-effects in different shifts is presented.

Regarding table 4, ANOVA test showed that reduction of BUN after hemodialysis caused significant decrease in the number of side-effects. Also, the lowest number of complications was seen in patients with low BP after dialysis against other patients.

Muscle cramps are the most common complications that were significantly related to PB after hemodialysis ($F=0.681$, $P<0.001$), but there was no significant correlation with other variables ($P>0.05$). There was no significant relationship between age, sex, weight and other variables with itching and other side effects.

Chi-square test declared that there was a significant relationship between gender and the number of side-effects ($P=0.015$). In other words, the frequency of females with 4 or more complications was more than the frequency of males. This study revealed that there was a significant relationship between working shift and the number of side-effects ($P=0.035$) so that among 34 patients who had 4 or more than 4 complications 20 ones (58.82%) were under dialysis on the night shift.

Discussion

According to the results of this study, in 43.66% of patients headache was observed. This result is consistent with a study that was conducted on the dialysed patients of Shahrekord hospital (11). Among various reasons, the speed of dialysis is possibly the reason for headaches, but in this study, there was no relationship between the headaches and the speed of dialysis ($P=0.269$) that might be due to the same speed in all dialysed patients.

In another study, the prevalence of this complication was reported to be 70.7% among all patients (12), which is different from the results of this study. The use of special membranes and higher speed of hemodialysis could be the probable

Table 1. Descriptive statistics of 142 patients under hemodialysis

Variable	Mean (SD)	Minimum	Maximum
Age	49.12 (11.696)	25	76
Dialysis speed	269.69 (18.138)	230	300
Duration of dialysis (month)	48.60 (10.117)	1	240
BUN befor dialysis	60.04 (17.612)	28	100
BUN after dialysis	23.10 (10.430)	4	68
Weight before dialysis (Kg)	58.35 (11.874)	34.50	90
Weight after dialysis (Kg)	63.06 (12.730)	37	92

Table 2. Frequency of adverse effects during hemodialysis

Complication	number of cases	% Of total
Muscle cramp	103	72.53
Itching	85	59.85
Headache	62	43.66
Backache	42	29.57
Hypotension	28	19.71
Chest pain	20	14.08
Pursiness	10	7.04
Vomiting	9	6.33
Abdominal pain	9	6.33
Hypertension	8	5.63
Ague	4	2.81
Bleeding	3	2.11

Table 3. The number of complications reported in hemodialysis patients based on shifts

Number of complications	Patients per shift			Total
	Morning	Evening	Night	Number (Percent)
1	24	26	11	61 (42.95)
2-3	15	19	13	47 (33.09)
Up to 4	6	8	20	34 (23.96)
Total	45	53	44	142 (100)

Table 4. Predictors of number of complications

Variable	MS	*F*	*P*
Age	327.25	0.324	0.418
Rate of dialysis	331.51	0.452	0.75
BUN befor dialysis	298.35	0.47	0.073
BUN after dialysis	351.726	0.62	<0.001
Weight befor dialysis	285.15	0.52	0.132
BP befor dialysis	292.85	0.163	0.157
BP after dialysis	329.582	0.42	0.007
Duration of dialysis	319.261	0.232	0.157

*Independent variable: number of complications

reason for this difference. According to the findings of this study, 72.53% of patients experienced muscle cramps complication, which is consistent with another study (13). By reviewing the literature, it is clear that muscle cramps might be due to various factors such as BP, weight, quick transpiration of water and electrolytes from the extracellular space (14, 15). About 79.71% of patients had hypotension during hemodialysis which is consistent with another similar study (15.1 %) (16). Santoro et al. (2002) consider old age as the causing factor of hypotension (17).

In a third study, the rate of hypotension was reported to be 72.5% which was not compatible with the present study (18). The difference in the type of samples and the use of different dialysis machines can cause this conflict. The rate of nausea was 6.33% in this study which was consistent with another research that was reported 9.4% (16). Based on recent studies, the reason for nausea and vomiting was found to be having meals during or 1 hour prior to dialysis (19). According to the result of a study, it was indicated that the level of nausea in semi-upright position was significantly less. Because in such situation, the volume of the lungs has increased and stomach secretions discharged earlier; therefore, nervous stimulations are reduced. This position can be offered to reduce nausea (20). The complication of itching was reported to be 59.85%, which was inconsistent with another study that reported it 14% (13). Various factors such as the type of device used for hemodialysis and the duration of sample monitoring can be involved in different results. Back pain and chest pain in hemodialysed patients of this study with the rate of 29.57% and 14.08% was also significant. According to available databases, no research has been done to measure or report this complication. The possible causes of this condition are pericarditis, starting dialysis with a high speed and hypotension (21). Therefore, by investigating and eliminating these causing factors, such as increased duration of dialysis and giving oxygen, the chance of incidence could be reduced. According to still another study, the incidence of fever was reported to be 4.5% which was consistent with the present study (13). Symptoms of Fever during hemodialysis requires careful consideration because it can be caused by infection or inappropriate blood transfusion; in this case, dialysis must be stopped and the solution be replaced if necessary (21). The complication of bleeding had the lowest rate in this study (2.11%), which has not been measured in any study according to available sources.

Conclusion

Given that the dissatisfaction of patients are due to the onset of side-effects such as muscle cramps, itching, gastrointestinal disturbances and hypotension, these complications can be considerably reduced by investigating the quality of dialysis in patients, reducing the pump rotation and nutrition education for patients and improving the quality and satisfaction of life for these people. Considering some limitations of this study, it is suggested that in future studies the patients be monitored over a longer time, and a variety of devices and solutions be used to evaluate the side-effects.

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