ORIGINAL ARTICLE

Frequency of Intradialytic Hypotension among Patients on Maintenance Heamodialysis

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ABSTRACT

Introduction: The study was a cross-sectional analytical study with 1907 hemodialysis sessions, in duration of three months for patients on maintenance hemodialysis with exception of those having age less than 10 years, duration of <3 months and those who developed vomiting, diarrhea or bleeding episodes pre hemodialysis.

Objective: The objective was to determine the frequency of intradialytic hypotension, and its relation with different risk factors**.**

Material and methods: Frequency of intradialytic hypotension was calculated and given as percentage. All the numerical variables like age, weight, dialysate temperature, blood flow etc. were given as mean and standard deviation. The association between intradialytic hypotension and qualitative risk factors were compared through z-test for proportion and quantitative risk factors with student t-test.

Results: Symptomatic intradialytic hypotension occurred during 5.4% of the total sessions. The pre-dialysis systolic, diastolic, mean blood pressures and pulse rate were observed higher in hypotensive group as compared to other group with the significant P values. The lowest systolic, diastolic and mean blood pressures were noted lower in hypotensive group with comparison to other group. However the mean change in pulse between the two groups (Hypotensive group -2.1±14.1 vs Normotensive group, -2.4±11.1 with p value 0.8) did not change significantly with drops of blood pressure. Cardiac event were also significantly high in hypotensive group.

Key words: Haemodialysis, intradialytic hypotension,

INTRODUCTION

Intradialytic hypotension (IDH) is a common clinical trait in hemodialysis (HD) which is caused by poor biocompatibility of the dialyzer membrane[1].

Dialysis-induced hypotension remains a significant problem in hemodialysis (HD) patients. Numerous factors result in dysregulation of blood pressure control and impaired myocardial reserve in response to HD-induced cardiovascular stress[2].

Hemodialysis (HD) is associated with significant reductions in the plasma concentrations of the nitric oxide (NO) inhibitors N(G)-monomethyl L-arginine (L-NMMA), asymmetric dimethylarginine (ADMA), and symmetric dimethylarginine (SDMA)[3].

Intradialytic hypotension is defined as lowering of mean blood pressure up to 20mmHg or more during hemodialysis associated with symptoms. If the patients on maintenance hemodialysis has pre hemodialysis systolic blood pressure <100 mmHg then fall in systolic blood pressure up to 10mmHg or more during hemodialysis associated with symptoms is called Intradialytic hypotension. If systolic blood pressure is more than 100mmHg then fall in systolic blood pressure up to 30 mmHg or more with related symptoms is called Intradialytic hypotension[4].

Many patients complained of feeling dizzy, light headed, or nauseated when hypotension occurs. It is closely correlated with other symptoms such as cramps, vomiting, and lack of alertness and darkening of vision[5]. In some patients there are no symptoms. Predisposing factors are now body mass (particularly in women), advanced age and cardiovascular disease[6]. Intradialytic hypotension occurs more in elderly patients (over 65 years of age) compared to younger patients (under 45 years of age).[7] The incidence of symptomatic hypotensive episodes is particularly high in patients who have normal or low blood pressure at the initiation of dialysis and in patients who have large interdialytic weight gains[8].

There are two types of Intradialytic hypotension. In one type (gradual hypotension), blood pressure declines gradually during hemodialysis. In other, there is sudden hypotension, characterized by an abrupt and sharp fall in blood pressure along with the appearance of symptoms. The pathophysiologic mechanisms are different in these two types.[9] Adenosine has definite role in sudden hypotension. Sub-typing of dialysis induced hypotension has also

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been done on the basis of heart rate behaviour, the classic tachycardiac collapse with an elevation in heart rate and a reduction in stroke volume and the so-called bradycardiac collapse with a paradoxical reduction in heart rate and an increase in stroke volume. Bradycardiac collapse were observed in 54% of the cases. The development of bradycardia and hypotension during hemodialysis appears to be related to a sudden parasympathetic vagal over activity and Bezold-Jarisch reflex[10].

Magnesium is a crucial mineral, involved in many important physiological processes. Magnesium plays a role of maintaining myocardial electrical stability in hemodialysis patients. Intradialytic hypotension is a common complication of dialysis and it is more common with acetate dialysate. The significance of the intradialytic changes of magnesium and their relation to parathyroid hormone (PTH) level and calcium changes during dialysis, and their relation to hypotensive episodes during dialysis are interesting. Intradialytic changes in serum magnesium have no correlation with intradialytic changes in serum calcium or with PTH level. However, it was significantly correlated with hypotension during the dialysis session, especially with acetate dialysate. Further investigations are needed to determine whether or not this is true in patients using bicarbonate dialysis[11].

Intradialytic hypotension is one of the most severe complications during hemodialysis. Its appearance is caused in part by rapid fluid removal with concomitant failure in blood pressure regulation but also by other dialytic-dependent and independent factors. In conclusion, multifrequent bio impedance assay is not capable to predict hypotension in the individual patient during a particular dialysis session[12].

Intradialytic hypotension is the most common complication associated with hemodialysis, and its cause is multifactorial. However, the relationship between hypertension and intradialytic hypotension is not clear. We investigated the influence of predialysis blood pressure and antihypertensive drugs on intradialytic hypotension. Diabetes, excessive interdialytic weight gain, low ejection fraction, and low left ventricular volume are independent risk factors for intradialytic hypotension. However, no correlation was found between predialysis blood pressure values or addition of antihypertensive medications and the incidence of intradialytic hypotension. Thus, hypertension may be controlled without aggravating intradialytic hypotension in hemodialysis patients[13].

Intradialytic hypotension is associated with significant mortality and morbidity. It is associated with increase risk of seizures, cerebral infarction, cardiac ischemia, arrhythmia and vascular access thrombosis. It is also associated with rapid loss in residual renal function and impairs the dialysis adequacy due to frequent interruptions and results in reduction in quality of life. It is common observation that dialysis patients are prone to episodes of IDH, if we found exact frequency and factors related to IDH, then we were able to reduce the frequency of IDH in patients by modifying the risk factors and dialysis prescription. This improved the quality of life of these patients.

MATERIAL AND METHODS

It was a cross sectional analytical study, performed with One hundred patients collected by using Non-probability convenience sampling at Hemodialysis unit, Nephrology Department, Shaikh Zayed Hospital Lahore. All adult patients on maintenance hemodialysis were included in this study with exception of those having age less than 10 years, on maintenance hemodialysis < 3 months duration and those on maintenance hemodialysis who develop vomiting, diarrhoea or bleeding episodes pre hemodialysis.

Data was analyzed by using SPSS version 15.0. Frequency of intradialytic hypotension during all hemodialysis sessions carried out during three months were calculated and given as percentage. All the numerical variables like age, weight, dialysate temperature, blood flow etc. were given as mean and standard deviation. The association between intradialytic hypotension and qualitative risk factors were analyzed through Chi Square test and quantitative risk factors with student t-test.

RESULTS

Total 1907 hemodialysis sessions were monitored in one hundred patients over a period of three months for the occurrence of hypotension and associated risk factors.

The mean age of the study population was 51± 16 years. There were 1086 males and 821 females with 56.9% and 43.1% frequencies respectively. As far as etiology of end stage renal disease was concerned the diabetic nephropathy secondary to diabetes mellitus was the most common cause with 51.1% frequency, hypertension was the second major cause with 24.2%, chronic glomerulonephritis with 13.2% obstructive nephropathy with 7.3% and other with 4.2% Fig.1.

When we looked into various possible contributions in dialysis sessions like dialyzer use, only 23.5% first use while 76.5% reuse dialyzers were used.

Out of one thousand nine hundred and seven dialysis sessions symptomatic hypotension occurred in one hundred and three sessions with frequency of 5.4%. All the dialysis sessions were divided into two groups, group I in which symptomatic hypotension occurred and group II included dialysis sessions not associated with symptomatic hypotension.

Various risk factors were compared between two groups. The blood pressure and pulse data was compared as shown in table 1. The pre-dialysis systolic, diastolic, mean blood pressures and pulse rate were observed higher in group I as compared to group II with the significant P values while the lowest systolic, diastolic and mean blood pressures were noted lower in group I with comparison to group II. However the mean change in pulse between the two groups (group I -2.1±14.1 vs group II, -2.4±11.1 with p value 0.8) did not change significantly with drops of blood pressure according to table 1.

Interdialytic weight gain and ultrafiltration rate were significantly higher in group I as compared to group II, while net ultrafiltration was higher in group II as compared to group I, which means that higher net ultrafiltration was achieved with lower ultrafiltration rate without any significant intradialytic hypotension in group II. The conductivity and dialysate temperature remained indistinct between two groups as shown in table 1.

There were no statistical differences observed in factors like, dialyzer reuse, antihypertensive medicines intake, occurrence of pyrexia during dialysis and food intake between two groups as mentioned below in table 2.

Fig.1: Distribution of hemodialysis sessions by diagnosis of patients

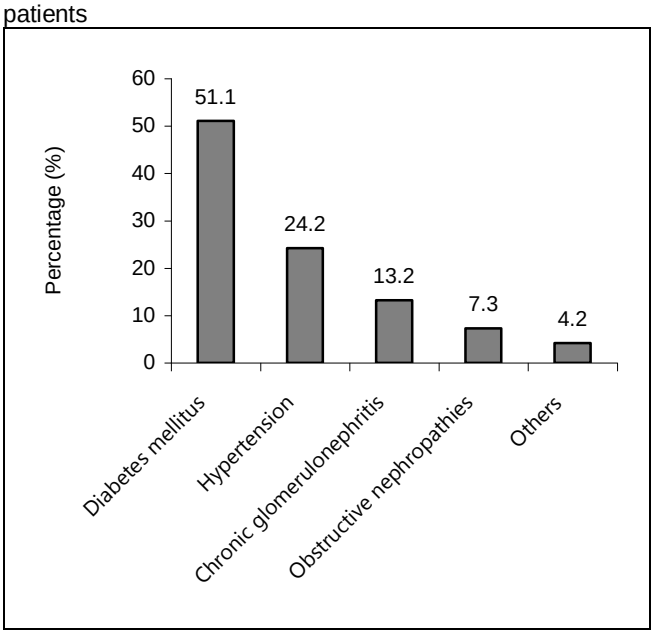

Table-1: Comparison of dialysis sessions with symptomatic hypotension with no symptomatic hypotension

Parameters	Group I(n=103) Mean ± SD	Group II (n=1804)Mean ±SD	P value
Age (Years)	48 ± 6	51 ± 15	0.07
Systolic blood pressure before dialysis (mmHg)	150 ± 27	143 ± 31	0.02
Diastolic blood pressure before dialysis (mmHg)	76 ± 6	72 ± 17	0.04
Mean blood pressure before dialysis (mmHg)	100 ± 118	96 ± 9	0.02
Pulse rate before dialysis (min)	84 ± 13	81 ± 14	0.05
Lowest systolic blood pressure (mmHg)	104 ± 28	130 ± 31	0.001
Lowest diastolic blood pressure (mmHg)	56 ± 16	67 ± 16	0.001
Pulse at lowest BP (min)	86 ± 15	84 ± 15	0.1
Lowest mean BP (mmHg)	72 ± 19	88 ± 19	0.001
Change in systolic BP (mmHg)	46 ± 22	13 ± 28	0.001
Change in diastolic BP (mmHg)	20 ± 15	6 ± 16	0.001
Change in mean BP (mmHg)	29 ± 15	8 ± 18	0.001
Change in pulse (min)	-2.1 ± 14.1	-2.4 ± 11.1	0.8
Weight gain (kg)	2.2 ± 0.7	2.1 ± 0.9	0.03
Net ultra filtration (ml)	1519 ± 750	1905 ± 890	0.001
Ultra filtration rate (ml/hour)	978 ± 636	636 ± 367	0.001
Conductivity (mS/cm)	13.9 ± 0.3	13.9 ± 0.3	0.2
Dialysate temperature (°C)	37.1 ± 0.2	37.1 ± 0.2	0.8

Table-2: Comparison between hypotensive and non hypotensive dialysis sessions

	Group I (n = 103)	Group II (n=1804)	P-value
Reused Dialyzers	77	1381	0.60
Anti hypertensive medicine intake	24	573	0.07
Pyrexia during dialysis	1	72	0.18
Food intake during dialysis	100	1717	0.70
Cardiac events	4	20	0.04

DISCUSSION

In our study the overall frequency of intradialytic hypotension was 5.4% as compared to internationally reported of almost 7.0%[14]. The largest study included 44,000 dialyses in France[15] and found the most common symptom was hypotension in 6.8% patients. A smaller but more detailed analysis found a higher incidence with hypotension being reported in 8.4% patients[16]. There is much decrease in frequency of intradialytic hypotension probably because of modern dialysis machines equipped with UF profiling module, sodium and UF profiling, use of bicarbonate dialysate and trained dialysis staff.

We found that females developed more episodes of intradialytic hypotension as compared to males in symptomatic hypotensive group (P=0.001).

Intradialytic weight gain is one of the recognized factor of intradialytic hypotension. In our study, the mean weight gain during hemodialysis sessions in group I was 2.2±0.7kg and in group II was 2.1±0.9kg with significant P value of 0.03. In a study conducted by Bland et al[17] the mean weight gain of hypotensive patients during hemodialysis sessions was 3.8kg. In another study conducted by Takeda et al[13] the mean weight gain of hypotensive patients in hemodialysis sessions was 2.45kg with P value of 0.01, which is comparable with our study. According to the study conducted by Tang et al[18] the interdialytic weight gain with sodium ramping haemodialysis was greater compared with constant sodium haemodialysis 3.1±1.0 vs 2.7±1.1 kg, P<0.001. The possible mechanisms of Interdialytic weight gain in our study are as follows:

1. Post dialysis raised serum sodium levels stimulated thirst mechanism leading to increased fluid intake resulted in increased interdialytic weight gain.
2. Correction of intradialytic hypotension with the replacement of intravenous fluid.
3. Failure to achieve dry body weight post dialysis.

According to Tang et al[18] sodium ramping was associated with some side effects. Interdialytic weight gain was greater although no patient experienced any severe sequelae of fluid overload such as congestive heart failure or pulmonary oedema.

The mean ultrafiltration rate in group I was 978±636 ml/hour and in group II was 636±367 ml/hour with significant P value of 0.001. A study by Schroeder et al[19] the mean ultrafiltration rate in hypotensive patients was 1471±601ml/hour. Increased UF rate resulted in rapid removal of fluid from intravascular compartment as a result the fluid from interstitial spaces started to shift in intravascular compartment to recover the compensation but rate of shift was slow as compared to rate of removal of fluid resulted in hypovolumia, decreased cardiac output, vasoconstriction and eventually intradialytic hypotension.

In our study accumulated (net) ultrafiltration was observed higher in group II even with relatively decreased interdialytic weight gain and low ultrafiltration rate. Probably it was as a result of insignificant change in blood pressure throughout the dialysis sessions.

Cardiovascular events are leading cause of morbidity and mortality during hemodialysis which is closely associated with intradialytic hypotension. In our study 3.8% sessions had cardiac events during dialysis in group I. The mechanism of cardiac events occurred due to high UF rate causing rapid removal of intravascular fluid resulting in hypovolaemia, peripheral vasoconstriction and myocardial ischemia. In another study conducted by Herzog[20] in hypotensive patients, 8% sessions had acute myocardial infarction during dialysis.

In our study the change in pulse rate in group I was -2.1±14.1 and in group II was -2.4±11.1. Normally pulse rate should rise with the drop of blood pressure, but in group I, change in pulse rate is less probably due to autonomic dysfunction (decreased sympathetic activity and negative ionotropic effect on cardiovascular system). As more than half of our patients were diabetic, and autonomic dysfunction is one of the complications in diabetes mellitus.

As in Straver et al study however, no significant differences in autonomic function were observed between hypotensive and stable patients. Although both groups showed impaired autonomic function, no significant correlation between changes in haemodynamics during dialysis and autonomic function at rest could be ascertained. In conclusions, hypotension during haemodialysis is not related to a patient's autonomic function at rest. This suggests that structural neuronal differences are not responsible for the severe decrease in systemic vascular resistance in intradialytic hypotension[21].

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