Tropical Journal of Nephrology Vol.7 No 1 June, 2012 27 - 31

Seasonal Variation in Blood Pressure Control in Patients on Maintenance Haemodialysis in LASUTH

Ajiyan OP*, Onyido OE*, Awobusuyi JO*, Umeizudike TI* and Amisu MA*

* Department. of Medicine, Lagos State University Teaching Hospital, Ikeja, (LASUTH), Lagos, Nigeria

ABSTRACT

Background: Seasonal variation in blood pressure control has been reported in both normotensive and hypertensive patients, this is of particular importance in patients with chronic kidney disease in whom cardiovascular events are the most important cause of morbidity and mortality. Studies on the impact of seasonal variation on blood pressure control in our environment are scarce.

Objective: To relate blood pressure control changes in patients on maintenance haemodialysis in LASUTH with seasonal changes.

Methodology: Retrospective Cohort study involving all patients on maintenance dialysis who were dialysed between the months of November 2012 and October 2013. Data were obtained from the dialysis record charts of the patients. The predialysis systolic, diastolic and mean arterial blood pressure readings were obtained, as well as the intradialysis readings during each hour of the dialysis session. Dry season was taken as the period between November and March, while rainy season was taken as period between April and October. Statistical evaluation was done using the students' T test.

Results: There was significant increment in all blood pressure readings obtained during rainy compared to dry season. Mean Systolic blood pressure being 154.08 $\pm$29.26 mmHg in the rainy season compared to 141.36 $\pm$ 24.68 mmHg in the dry season ($p < 0.05$). These pattern was observed also in the intradialysis blood pressure readings.

Conclusion: It was concluded that seasonal variation in blood pressure of patients on haemodialysis exists in our environment with higher values during the rainy season. The impact of this observation on morbidity and mortality of our dialysis population needs to be evaluated.

Keywords: Season, blood pressure, seasonal variation, Nigeria, dialysis, weight changes

INTRODUCTION

Chronic kidney disease is an important cause of morbidity and mortality worldwide with increasing prevalence globally [1]. The true prevalence of chronic kidney disease in Nigeria is unknown because the disease is thought to be under-reported. Prevalence rates reported in Nigeria range from 8% to as high as 45.5% [2, 3, 4, 5] being 18-21% in the general population with higher prevalence figures in special populations such as hypertensives and diabetics. Prevalence rate of ESRD is estimated to be between 1.6% to 12.4% [6]. In patients with End Stage Renal Disease on maintenance dialysis, cardiovascular diseases are the most important cause of morbidity and mortality and hypertension is a major risk factor for cardiovascular events [7, 8]. The prevalence of sustained hypertension in patients on dialysis has been reported to be over 50% [9], good control of hypertension prolongs survival in such patients.

Corresponding author: - Dr. Ajiyan OP

Department of Medicine, Lagos State University Teaching Hospital, Ikeja (LASUTH), Lagos

.E-mail: - yemiawo@yahoo.com

In normal subjects, genetic as well as geographical factors are determinants of blood pressure [10]. Geographical factors to be considered include, seasonal changes with resulting variation in temperature and humidity.

Seasonal variation in blood pressure in the general population and in patients on dialysis have been reported, usually in the context of winter and summer seasons. The causes of seasonal variation in blood pressure control are not clear but studies have reported an inverse relationship between blood pressure and environmental temperature [11]. Few studies have been reported on the seasonal changes in blood pressure in this part of the world.

Nigeria primarily features a tropical kind of climate where it is usually humid all year round, especially in the southwest where this study was conducted. There are primarily 2 seasons within the country: 1) Dry season – from the month of November to March 2) Rainy Season – from April to October. Ambient temperature is generally higher during the dry season ranging from 31.0 – 33.1 celsius, compared with 28.1- 32.1 celsius in the rainy season [12].

AIM

This study aimed to relate blood pressure changes in patients on maintenance haemodialysis at the dialysis centre in Lagos State University Teaching Hospital with season changes within the country.

METHODOLOGY

Study Design: A retrospective cohort study involving all patients on maintenance haemodialysis dialysed within the months of November 2012 to October 2013 .

Study Location: Dialysis centre of Lagos State University Teaching Hospital, Ikeja, Lagos.

Methods: Data were obtained from the patients dialysis charts recorded over the said period of time at the dialysis centre LASUTH.

Information obtained include; Patients predialysis systolic (SBP), diastolic (DBP) and mean arterial blood pressure (MAP), for the period of study. The same parameters were collected for each hour intradialysis. The Interdialysis weight gain was also recorded.

Dry season was taken as the period between November to March, and rainy season, from April to October.

A total of 212 dialysis sessions were studied, with data collected as previously outlined.

Data are expressed as mean and standard deviation. Mean arterial pressure was calculated as 1/3 of pulse pressure (SBP – DBP) plus DBP. Statistical evaluation was done using the 2 tailed students-T test. Statistical significance was accepted as $p < 0.05$.

RESULTS

The mean predialysis BP was 154.08/88.5mmHg in the rainy season compared to 141.36/80.82mmHg in the dry season and was statistically significant.

Evaluation of mean intra-dialysis blood pressures shows that mean blood pressures were also higher during the rainy season compared with dry season throughout dialysis treatment. This was also statistically significant. [Table 1]

The Mean interdialysis weight gain was however, found to be higher in the dry season 3.62kg $\pm$2.09 compared to 2.49kg $\pm$2.02 in the rainy season but $p > 0.05$.

DISCUSSION

Of the 212 sessions studied, a statistically significant higher mean predialysis SBP, DBP and MAP was observed during the rainy season as compared to the dry season. A similar trend was observed in the hourly intradialysis blood pressure measurements in the 2 seasons. These findings of increased mean blood pressure during the rainy season correlate with numerous studies done in other regions of the world where ambient temperature has been found to have an inverse relationship with blood pressure control.

Numerous studies have shown a variation in blood pressure during different seasons, this has been documented for normotensive, hypertensive and even patients with chronic kidney disease [1, 2]. Most of these studies were conducted using western seasonal changes, studies within our locality are scarce.

Angel Argilles *et al*, [9] in a study conducted in France in patients on chronic haemodialysis over a 4 year period, found a consistent cyclical variation in systolic and diastolic blood pressure during the study

		Rainy	Dry	p value	Remarks
Pre-Dialysis	SBP	154.08 ±29.26	141.36 ±24.68	<0.05	significant
	DBP	88.51 ±20.55	80.82 ±13.92	<0.05	significant
	MAP	110.37 ±22.19	101 ±15.89	<0.05	significant
1hr Intradialysis	SBP	157.13 ±26.73	134.45 ±20.43	<0.05	significant
	DBP	88.77 ±18.54	78.52 ±12.5	<0.05	significant
	MAP	111.56 ±19.95	97.17 ±13.19	<0.05	significant
2hrs Intradialysis	SBP	158.53 ±28.88	139.48 ±19.54	<0.05	significant
	DBP	88.15 ±18.74	79.33 ±13.91	<0.05	significant
	MAP	111.61 ±20.61	99.38 ±13.47	<0.05	significant
3hrs Intradialysis	SBP	160.24 ±28.90	141.67±27.24	<0.05	significant
	DBP	88.74 ±18.85	77.83 ±13.10	<0.05	significant
	MAP	112.57 ±20.60	99.11 ±15.67	<0.05	significant
4hrs Intradialysis	SBP	161.77 ±29.79	146.19 ±27.97	<0.05	significant
	DBP	88.18 ±19.34	77.57 ±13.55	<0.05	significant
	MAP	112.71 ±21.04	100.44 ±16.53	<0.05	significant
Inter-dialysis weight changes		2.49 ±2.02	3.62 ±2.09	>0.05	not significant

period with an inverse relation between maximal temperature and SBP and DBP.

Also, in a study conducted in Brazil, investigating the seasonal variation in BP of 16 patients on maintenance haemodialysis, Manuel Carlos *et al* [8] reported a significant reduction in both DBP and mean predialysis SBP during summer when the average temperature was higher. There was however, no significant change in interdialysis weight gain in their studied subjects. Alfred K. Cheung *et al* [10] in their study, using data obtained from the Haemodialysis (HEMO) study group, also found similar relationship between predialysis BP, ultrafiltration volume and the outdoor temperature as has been observed by others, but the predialysis body weight in their study, also had an inverse relationship with outdoor temperature.

The cause of the noticed seasonal variation in BP in humans is yet to be fully understood, but numerous hypothesis has been put forth; The high temperature noted, in summer and dry season, result in vasodilatation, which inturn is thought to decrease peripheral vascular resistance and blood pressure [8]. Indeed, a study conducted in Japan reported an increased in blood pressure in winter associated with increased urinary catecholamine excretion [12]. This might butress the assumption that seasonal variation in blood pressure is due to activation of the sympathetic nervous system.

Another mechanism is through modification of the extracellular fluid, since insensible fluid loss (via perspiration, transpiration) increases with higher temperatures. This is may be an important mechanism in patients with end stage renal disease whose hypertension is to a large extent volume dependent [9]

Newer hypothesis suggests the role of vitamin D in the seasonal and geograhical variation of blood pressure. Vitamin D is known to be related to sun exposure (25(OH) vitamin D) with greater serum levels with higher sun exposure. 25(OH)vitamin D has been shown to have a link with blood pressure, irrespective of iPTH modulation [15], this relationship is an inverse one with lower levels of vitamin D associated with higher blood pressure. The effect of vitamin D is thought to be due to the negative regulatory effect it has on the renin-angiotensin system and therefore blood pressure [16]. Serum vitamin D level wasn't measured in this study, it would have made an interesting study given the geograhical location in which our study was carried out.

The importance of good blood pressure control in patients with advanced chronic kidney disease cannot be overemphasized, as it has been proven to improve morbidity and mortality. There is need for more local studies evaluating this association with a goal of ascertaining the clinical relevance of this observation to morbidity and mortality in the haemodialysis population.

Though this study showed a slightly higher incidence of interdialysis weight gain during the dry season in contrast to numerous studies, this wasn't statistically significant.This slightly higher values might be due to increased fluid ingestion during the dry season. More studies from varying centres in the country will need to be conducted to investigate this association.

CONCLUSION

This study shows that the seasonal variation in blood pressure of patients on haemodialysis exists in our environment as reported in other regions of the world. This may be as a result of variation in the atmospheric temperature in the seasons. Further studies to demonstrate similar patterns in other parts of the country will be necessary, as well as investigation into the impact of these blood pressure variations on the morbidity and mortality of patients on haemodialysis.

REFERENCES

1. National Kidney Foundation/ KDOQI Executive Summaries 2000 American Journal of Kidney Diseases 2002; 40(6): E19 –E 22
2. Akinsola A, Odesanmi W O, Oguniyi J O and Ladipo GOA. Diseases causing chronic renal failure in Nigerians- a prospective study of 100 cases. Afr J Med Sci 1989;18: 131-137
3. Afolabi MO, Abioye Kuteyi EA, Arogundade FA and Bello IS. Prevalence of chronic kidney disease in a Nigerian family practice population. SA. Fam Prac. 2008; 51(2): 132-137
4. Abioye Kuteyi EA, Akinsola A and Ezeoma IT. Renal Disease: The need for community based screening in rural Nigeria. Afr J Med Pract 1999; 6 (5): 198-201
5. Nwankwo EA, Nwankwo B and Mubi B. Prevalence of impaired kidney function in hospitalised hypertensive patients in Maiduguri, Nigeria. The Internet Journal Of Internal Medicine.2005 Volume 6 Number 1. (Accessed: 20th Nov 2013)
6. Epidemiology of End Stage Renal Disease in Nigeria the way forward Odubanjo MO Oluwasola AO, Kadiri S. . Int Urol Nephrol. 2011 Sep; 43(3): 785-792. doi: 10.1007/s11255-011-9903-3. Epub 2011 Feb 15.
7. Degoulet P, Reach I, Aime F, Rioux P, Jacobs C and Legrain M. Risk factors in chronic haemodialysis. Proc Eur Dial Transplant Assoc 1980;17:149-154
8. Vincenti F, Amend WJ, Abele J, Feduska NJ and Salvatierra O Jr. The role of hypertension in hemodialysis-associated atherosclerosis. Am J Med 1980; 68: 363-369
9. Hunting J, Kramer W, Schutterle G and Wizemann V. Analysis of left ventricular changes associated with chronic haemodialysis: a noninvasive follow-up study. Nephron 1988; 49: 284-290
10. Angel Argilles, George Mourad and Charles Mion. Seasonal Changes in Blood Pressure in Patients with End Stage Renal Disease Treated with Haemodialysis. New England Journal Of Medicine 1998; 339:1364-1370
11. Brennan PJ, Greenberg G,Miall W E and Thompson SG. Seasonal variation in arterial blood pressure. BMJ 1982; 285: 919-923

12. Encyclopedia of the Nations » Africa » Nigeria. http://www. nationsencyclopedia. com/Africa/Nigeria-CLIMATE.html (Accessed: - 11th Jan 2014)

13. Hata T, Ogihara T, Maruyama A *et al.* The seasonal variation of blood prssure in patients with essential hypertension. Clin Exp Hypertens A 1982; 4(3): 341-354

14. Manuel Carlos, Decio Mion Jr, Marcello Marcondes *et al.* Seasonal variation of blood pressure in maintainance haemodialysis. Rev Paul Med 1998; 116(4): 1774-1777

15. Argiles A, Lorho R, Servel M *et al* . Blood Pressure is correlated with vitamin D3 Serum levels in Dialysis patients. Blood Purif 2002; 20: 370-375

16. Yan Chun Li, Guilin Qiao, Milan Uskokovic *et al*. Vitamin D: a negative endocrine regulator of the renin- angiotensin system and blood pressure. J Steroid Biochem Mol Biol. 2004; 89-90(1-5): 387-92