

# Electrolyte Disturbance among Hypertensive Patient In Baquba teaching hospital , Diyala , Iraq

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**ABSTRACT--***T Hypertension attack about ¼ of adult's people all over the world, this attack come from the internal and external surrounding environment. Electrolyte imbalances are common findings in many diseases Sodium, potassium, calcium, and other ions should be balanced and any change in ions value must take inconsideration as a colligative and associated style, any investigation have to stress of understanding of clinical scenario searching on successful and effective therapy. In this study we took these electrolyte and study their disturbance in the hypertensive patient and connect it to other disorders like diabetes and IHD.*

*A case – control study was done in Ba'quba Teaching hospital , Diyala , Iraq during the period of 16th of septemper 2018 – 3rd of January 2019 on one hundred primary person were included in our study , Eighty one were the cases who have hypertension ( 55 female and 25 male ) compared to a twenty healthy person” Control” ( 11 female and 10 male ) which the take information by questionnaire then aspirate blood and send for investigation (Na, Cl , K , Ca , Phosphorus , B.Urea , S.Creatinine , RBS And HBA1c )*

*Then classify them into three groups : first who had hypertension and IHD only , second who had Hypertension and Diabetes and third group who had Hypertension , Diabetes and IHD .*

*The result of our study demonstrate that the first group had a significant reduce in serum magnesium and increase of serum NaCl , the second group demonstrate that there is significant reducing in serum Mg<sup>++</sup> , Ca<sup>++</sup> and K<sup>+</sup> and increase in serum Nacl , third group demonstrates significant reducing of serum Mg<sup>++</sup>.*

*In this study we demonstrate a significant reduction in both serum magnesium and calcium levels among patients with hypertension , diabetes, and significant inverse correlation of both serum magnesium and calcium with hypertension ,diabetes and cardiovascular diseases*

**Keywords--***Hypertension , Electrolyte disturbance ,Diabetes , Ischemic heart disease, Sodium , Potassium Magnesium, calcium .*

## I. INTRODUCTION

One quarter of the world people are suffering from hypertension and it's expected to this value to reach 60% of the whole population within the year 2025 according to increasing the hypertension patients by the years[1]. Therefore, the hypertension considers the most common risk factor of cardio disease which is usually lead to the high ration of the death around the world[2]. High ratio of the hypertension disease are known as essential or idiopathic hypertension, which is form about 95% of the total patients[3].

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As mentioned hypertension come as a results of internal and external environment.  $\text{Na}^+$  is the most important extracellular ion which play the pivotal environmental factor in the disorder. This cation has been showed less effectivity in the pathogenesis hypertension. Many of clinical study reach to the negative effects of  $\text{Na}^+$  cation of the arterial pressure [4-7]. While the  $\text{K}^+$  is consider the main intracellular ion which proven to be the first factor of pathogenesis hypertension. There are a lot of studies lead to that the shortage or the of  $\text{K}^+$  cation play critical role in hypertension and cardio diseases [8-10].

Essential hypertension in human being is consider very complex multifactorial, quantitative trait under polygenic control. The reasons of essential hypertension are still unknown, the dynamic defects of the hypertension are represented by increasing in the resistance of the peripheral because of fluctuations in vascular function and vascular structures. The fluctuations may happen in arterial thinks, vascular tone, endothelial dysfunction. [9]. Cardio related diseases (CVD), stroke, and renal system disease are considering the common reasons for death by hypertension being the predominant risk factor [10].

Body liquids and cation balance should be maintained for the management in many clinical state. Ions and pH imbalances are the major results in too many diseases [11,12]. Fluctuation in each cation must be taken in consideration in colligative fashion, and investigation must reach to clarify the clinical strategy for an effective and successful therapy.  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{++}$ , and  $\text{Mg}^{++}$  are the most of important and prevailing of the electrolyte imbalances.

Studies regarding to pH and ion imbalance usually listed the disorders are usually happened in old and critically ill patients, in addition to other chronic disease patients like diabetes mellitus and renal system failures and cardio diseases such as MI patients.[13-15] .

pH and ion fluctuation normally happened in some clinical disease and may happened as consequences of therapeutic interventions, normally in old patients especially those with congestive heart failure such as hyponatremia, hypokalemia, and hypomagnesemia[16 – 18] . The later diseases are observed with other patients including obesity patients [19]. Diuretic medicines may use to exacerbate cations and electrolyte imbalance in cardiac insufficiency patients [20]. The earlier studies reported the cations fluctuations usually coincident with. They also reported that hypokalemia and hypomagnesemia are usually walked in parallel[21].

## II. Patient & method

A case – control study was done in Ba'quba Teaching hospital , Diyala , Iraq during the period of 16th of september 2018 – 3rd of January 2019 on a patient whom admitted to the 3rd floor of Ba'quba Teaching hospital A one hundred primary person were included in our study , Eighty one were the cases who have hypertension ( 55 female and 25 male ) compared to a twenty healthy person” Control” ( 11 female and 10 male ) who were free of Hypertension , Diabetes , Renal failure , Addison disease , Gastro-enteritis , and Legionnaires' disease . A questionnaire was given to the patient that contain the demographic features of patient ( name , age , sex , ethnic group and address ) , history about his chronic medical illness and complications ( Ischemic heart disease , Hyperlipidemia , Diabetes , Retinopathy , Nephropathy and Peripheral nerve disease ) and a history of a current drug use .

- A blood sample was collected and prepared to investigation for ( Sodium , Potassium, Chloride , Calcium , Phosphorus , Urea , Creatinine , Random Blood Sugar and HBA1c ) by (Roche) COBAS INTEGRA 400 plus devise which use the photometer to obtain the result in Ba'quba Teaching Hospital Center Labs then stored in deep freeze (-80 C°) then send to investigation for Magnesium by Spectro Photometer by manual way in a privet Lab .

We classify the patient into three groups

- The first group included patient who had Hypertension and Ischemic heart disease ( No. 21 ) compared to normal person ( No.14 )

- The second group included patient who had Hypertension and diabetes ( No. 20 ) compared to normal person ( No.21 )

- The third group included patient who had Hypertension , Ischemic heart disease and Diabetes ( No. 19 ) compared to normal person ( No.19 )

Finally the result was collected by Microsoft Excel and statistically analyzed in a comparison study depended on T test and P value . The aim of our study to demonstrate the relation between electrolyte disturbance and Hypertension and another co morbid diseases like Diabetes and Ischemic heart disease.

### III. Result

The result of our study was a follow

Table 1 : Sex distribution of patients :

Sex	No.
Male	35
Female	65

Table 2 : Age Distribution among patients :

Age range in Year	No.
< 40	27
41 – 50	14
51 – 60	19
61 – 70	21
> 70	18

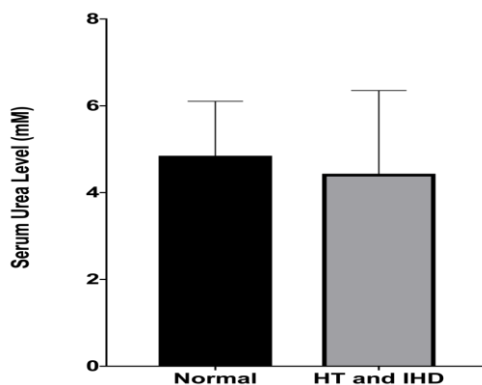


Figure 1(A) . Serum urea level in hypertensive patients with IHD. Data are expressed as Mean  $\pm$  SEM. Unpaired t-test was used to compare between data in each group (n=21 normal; n=14 hypertensive with IHD). Subsequently, differences between groups were considered statistically significant when  $P < 0.05$ .

This figure shows that serum Urea level in patient complaining of hypertension and ischemic heart disease is decreased in comparison to normal but statistically not significant.

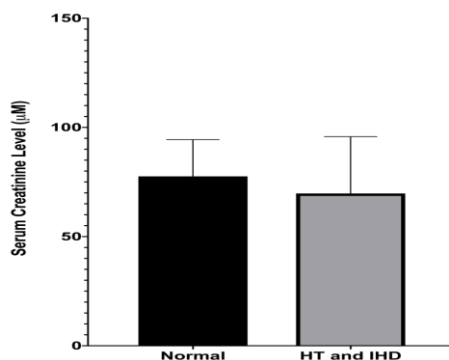


Figure 1(B) . Serum creatinine level in hypertensive patients with IHD. Data are expressed as Mean  $\pm$  SEM. Unpaired t-test was used to compare between data in each group (n=21 normal; n=14 hypertensive with IHD). Subsequently, differences between groups were considered statistically significant when  $P < 0.05$ .

This figure shows that serum Creatinine level in patient complaining of hypertension and ischemic heart disease is decreased in comparison to normal patient but statistically not significant.

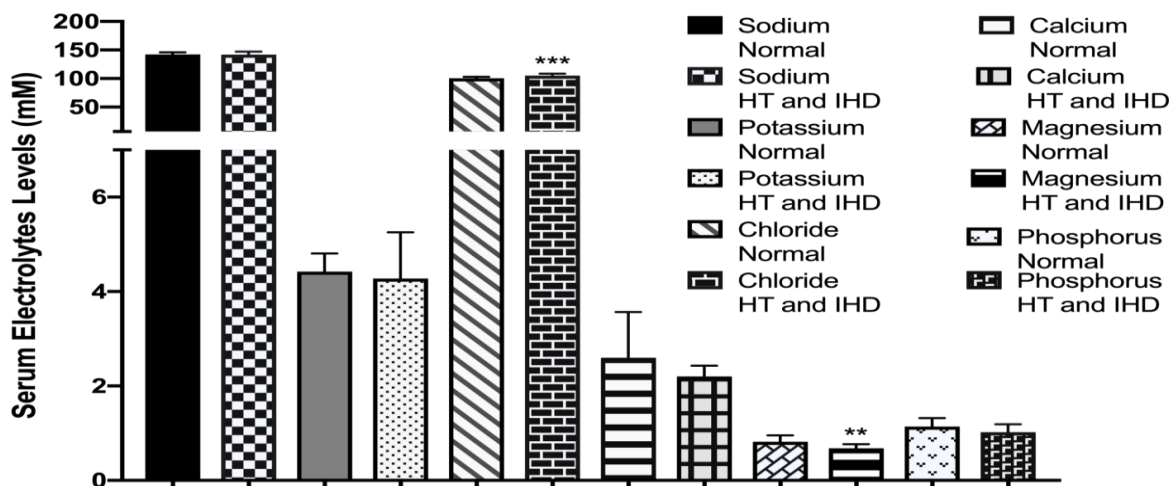


Figure 1(C) Electrolytes disturbances in hypertensive patients with IHD. Data are expressed as Mean  $\pm$  SEM. Unpaired t-test was used to compare between data in each group (n=21 normal; n=15 hypertensive with IHD). Subsequently, differences between groups were considered statistically significant when  $P < 0.05$ . \*\* $P < 0.01$ , \*\*\* $P < 0.001$ .

Regarding patient with hypertension and IHD this figure shows very highly significant increase in serum Chloride in comparison to normal person, highly significant decrease in serum Magnesium in comparison to normal person, decrease in serum Potassium, Calcium and Phosphorus in comparison to normal person but statistically not significant and increased in serum Sodium could be noticed in comparison to normal person but statistically not significant.

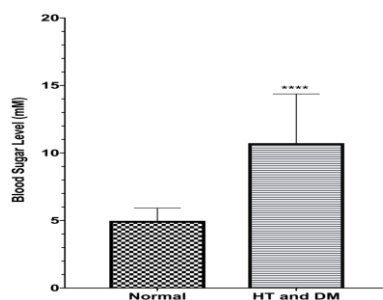


Figure 2(A). Blood sugar level in hypertensive patients with DM. Data are expressed as Mean  $\pm$  SEM. Unpaired t-test was used to compare between data in each group (n=19 normal; n=20 hypertensive with DM). Subsequently, differences between groups were considered statistically significant when  $P < 0.05$ . \*\*\*\* $P < 0.0001$

This figure shows that there is a very highly significant increase in Blood Sugar among patient with diabetes and hypertension in comparison to normal person.

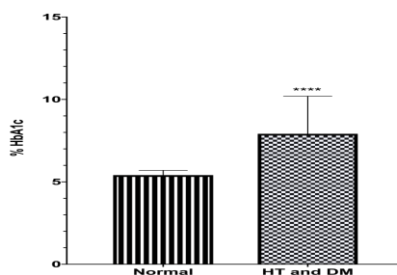


Figure 2(B). HbA1c% in hypertensive patients with DM. Data are expressed as Mean  $\pm$  SEM. Unpaired t-test was used to compare between data in each group (n=21 normal; n=22 hypertensive with DM). Subsequently, differences between groups were considered statistically significant when  $P < 0.05$ . \*\*\*\* $P < 0.0001$

This figure shows that there is a very highly significant increase in HbA1c among patient with diabetes and hypertension in comparison to normal person.

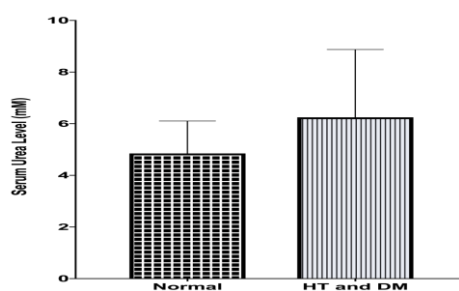


Figure 2(C) . Serum urea level in hypertensive patients with DM. Data are expressed as Mean  $\pm$  SEM. Unpaired t-test was used to compare between data in each group (n=21 normal; n=19 hypertensive with DM). Subsequently, differences between groups were considered statistically significant when  $P < 0.05$ .

This figure shows that serum Urea level in patient complaining of hypertension and diabetes is increased in comparison to normal person but statistically not significant.

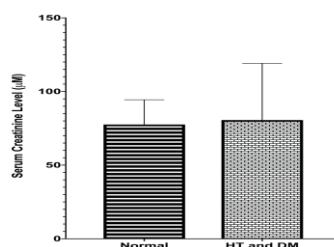


Figure 2(D) . Serum creatinine level in hypertensive patients with DM. Data are expressed as Mean  $\pm$  SEM. Unpaired t-test was used to compare between data in each group (n=21 normal; n=20 hypertensive with DM). Subsequently, differences between groups were considered statistically significant when  $P < 0.05$ .

This figure shows that serum Creatinine level in patient complaining of hypertension and diabetes is increased in comparison to normal person but statistically not significant.

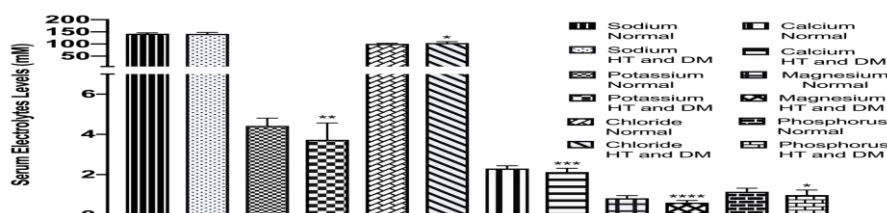


Figure 2(E) . Electrolytes disturbances in hypertensive patients with DM. Data are expressed as Mean  $\pm$  SEM. Unpaired t-test was used to compare between data in each group (n=21 normal; n=21 hypertensive with DM). Subsequently, differences between groups were considered statistically significant when  $P < 0.05$ . \* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$ , \*\*\*\* $P < 0.0001$ .

Regarding patient with hypertension and diabetes this figure shows very highly significant decrease in serum Magnesium in comparison to normal person , highly significant decrease in serum Calcium and Potassium in comparison to normal person , significant decrease in serum Phosphorus in comparison to normal person , significant increase in serum Chloride in comparison to normal person and no change in serum Sodium can be noticed in comparison to normal person .

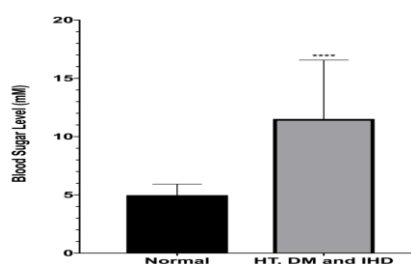


Figure 3(A) . Blood sugar level in hypertensive patients with DM and IHD. Data are expressed as Mean  $\pm$  SEM. Unpaired t-test was used to compare between data in each group (n=19 normal; n=19 hypertensive with DM and IHD). Subsequently, differences between groups were considered statistically significant when  $P < 0.05$ .

\*\*\*\* $P < 0.0001$

This figure shows that there is a very highly significant increase in Blood Sugar among patient with diabetes , hypertension and Ischemic heart disease in comparison to normal person.

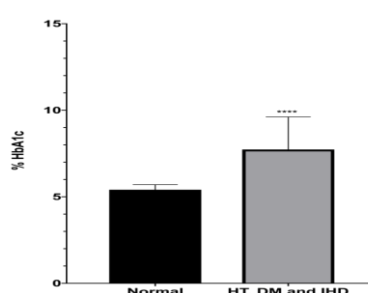


Figure 3(B ) . HbA1c% in hypertensive patients with DM and IHD. Data are expressed as Mean  $\pm$  SEM. Unpaired t-test was used to compare between data in each group (n=21 normal; n=21 hypertensive with DM and IHD). Subsequently, differences between groups were considered statistically significant when  $P < 0.05$ . \*\*\*\* $P < 0.0001$

This figure shows that there is a very highly significant increase in HBA1c among patient with diabetes , hypertension and Ischemic heart disease in comparison to normal person.

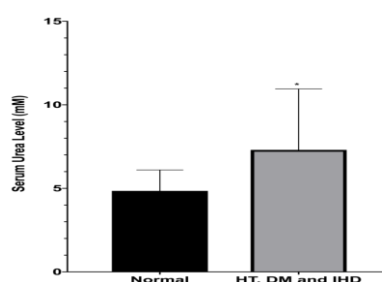


Figure 3(C ) . Serum urea level in hypertensive patients with DM and IHD. Data are expressed as Mean  $\pm$  SEM. Unpaired t-test was used to compare between data in each group (n=21 normal; n=16 hypertensive with DM and IHD). Subsequently, differences between groups were considered statistically significant when  $P < 0.05$ . \* $P < 0.05$ .

This figure shows that there is a significant increase in serum Urea among patient with diabetes , hypertension and Ischemic heart disease in comparison to normal person .

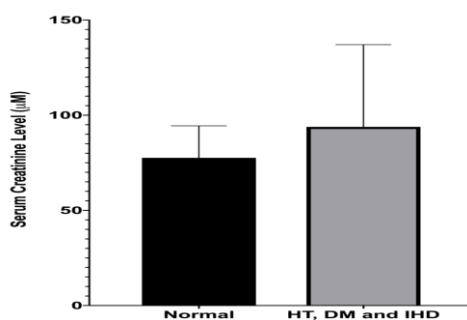


Figure 3(D) . Serum creatinine level in hypertensive patients with DM and IHD. Data are expressed as Mean  $\pm$  SEM. Unpaired t-test was used to compare between data in each group (n=21 normal; n=17 hypertensive with DM and IHD). Subsequently, differences between groups were considered statistically significant when  $P < 0.05$ . This figure shows that serum Creatinine level in patient complaining of hypertension , diabetes and ischemic heart disease is increased in comparison to normal person but statistically not significant.

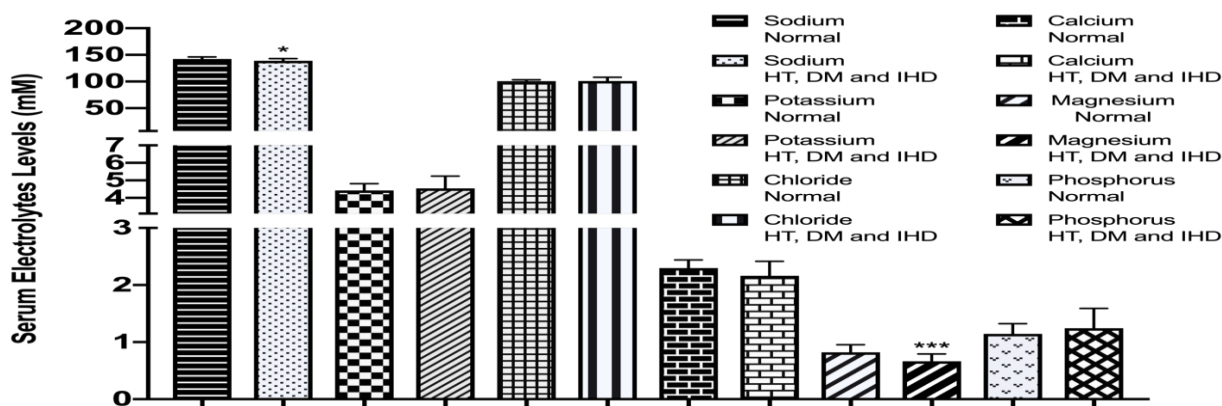


Figure 3(E) . Electrolytes disturbances in hypertensive patients with DM and IHD. Data are expressed as Mean  $\pm$  SEM. Unpaired t-test was used to compare between data in each group (n=21 normal; n=21 hypertensive with DM and IHD). Subsequently, differences between groups were considered statistically significant when  $P < 0.05$ . \* $P < 0.05$ , \*\*\* $P < 0.001$ .

Regarding patient with hypertension , diabetes and ischemic heart disease , this figure shows very highly significant decrease in serum Magnesium in comparison to normal person, significant decrease in serum Sodium in comparison to normal person , increase in serum Potassium , Chloride and Phosphorus in comparison to normal person but statically not significant and decrease in serum Calcium in comparison to normal person but statistically not significant .

#### IV. Discussion

Ion concentrations are contributed precisely in between intra- and extracellular compartments for sustaining the physiological process and functions of the muscles cells and nerves cells. Kidneys are the very important organ for regulation pH and ions concertation is the kidney, other supported mechanisms such as hormonal like antidiuretic hormone, aldosterone and parathyroid hormone are also play an important role in this process. Any dysfunction in any organ of this systems may lead to the electrolyte fluctuations and results in abnormalities. can relase intracellular  $Ca^{++}$  concentration and thereby cause vasoconstriction .



Regarding the result of the second group which is comparison between patients complaining from Hypertension and Diabetes with normal cases. There is very highly significant increase of both blood sugar and HbA1c level in patients Hypertension and Diabetes as compared with normal cases as a result of poor glycemic control.

Very highly significant decrease in serum magnesium level of patients with Hypertension and Diabetes as compared with normal cases which agree with other studies <sup>64</sup> which found that diabetes, hypertension and dyslipidemia were inversely related with serum Mg levels, serum magnesium affects blood pressure by modulating vascular tone and reactivity, it acts as a calcium channel antagonist result in vasodilatation (release of vasodilators nitric oxide, prostacyclins) so magnesium deficiency or changes in its metabolism are related to the pathophysiology of hypertension, atherosclerosis, insulin resistance.

Highly significant decrease in serum calcium level among patients with (DM and HT) as compared with normal cases which agree with other studies <sup>70,71</sup>, the possible causes are inhibition of Ca(2+)-ATPase activity, renal insufficiency, concurrent hypomagnesemia and diuretic use. Decrease in both serum potassium and phosphorus levels among patients with (DM and HT) as compared with normal cases but statistically not significant. Increase in serum chloride level among patients with (DM and HT) as compared with normal cases but statistically not significant.

## V. Conclusion

Electrolyte disturbance are an important issue because they associated with renal damage and hypertension and another co morbid disease so increase morbidity and mortality. In this study we demonstrate a significant reduction in both serum magnesium and calcium levels among patients with hypertension, diabetes, and significant inverse correlation of both serum magnesium and calcium with hypertension, diabetes and cardiovascular diseases.

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