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RESEARCH ARTICLE

IDENTIFYING PREDICTORS OF BLOOD PRESSURE CONTROL IN THE JORDANIAN POPULATION :A NATIONAL, MULTICENTRIC SURVEY

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Abstract

The high percentage of uncontrolled hypertension is a main challenge in Eastern Mediterranean region. In order to improve this situation, controlling or treating factors related to poor Blood pressure (BP) control is needed. This survey was conducted to identify the predictors of BP control in hypertensive Jordanian patients followed up for 6 months. The study was a national, multicentre, observational prospective cohort survey conducted in 401 newly diagnosed or uncontrolled essential hypertension patients. Diabetes was identified as a predictor of poor blood pressure control at 1 month (OR = 0.07, CI = 0.03 to 0.16) and at 6 months (OR = 0.09, CI = 0.03 to 0.27) while the early control of blood pressure at 1 month was associated with a better control at 6 months (OR= 13.88, CI = 5.21 to 36.98). In the diabetic subgroup, old age was associated with poor control (OR = 0.95, CI= 0.92 to 0.99) while early control of blood pressure at 1 month (OR = 55.71, CI= 9.56 to 318.11) and use of combination antihypertensive therapy at baseline and 1 month (OR = 5.01, CI= 1.09 to 24.60) respectively were associated with good blood pressure control at 6 months. The percentage of patients with controlled BP after 6 months of treatment (63.49%) was significantly higher ($p<0.001$) than the percentage of those with controlled BP after 1 month (40.94%). We conclude that early control of blood pressure was found to be a significant predictor of good blood pressure control, while diabetes was found to be a predictor of poor blood pressure control.

Introduction:-

According to WHO in 2013, the Eastern Mediterranean region, including Jordan, has the second highest hypertension (HTN) prevalence in adults (after Africa) as compared to other regions such as Americas, Europe, and South-East Asia. It affects around one billion people all over the world and it is the main risk factor for cardiovascular disorders such as heart attacks and strokes. HTN is the cause of 45% of deaths resulting from heart disease at least and 51% of deaths resulting from stroke [1].

Worldwide, cardiovascular disorders are the leading cause of death. Annually, 17.3 million deaths occur worldwide and the rate is expected to reach 23.6 million annual cases by 2030. Nearly 80% of deaths due to cardiovascular

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disease occur in low- and middle-income countries, where the number of patients with uncontrolled blood pressure varies by countries and these patients are the main challenge for treating hypertension [1-3].

Globally, low blood pressure (BP) control rates have been difficult to explain, given the number of effective drugs available for management of the disease. The main barriers to BP control include patient's access to care, medical practice patterns, patient education, and poor compliance to prescribed treatment, patient cardio-metabolic profile and socioeconomic status [4-6]. However, poor BP control is also determined by other factors, including age, severity of disease, health habits, early control and co-morbidities [7].

One of the main solutions towards better BP control rates is the identification of factors that can affect/ predict blood pressure control. Further understanding of those predictors can help provide special care to patients at a higher risk of poor control. This should eventually enhance the control rates. Our study is a national, multicentre, observational, prospective cohort survey that aimed at identifying the predictors of BP control in hypertensive Jordanian patients followed up to 6 monthsin addition toidentifying the predictors after 1 month of follow-up and the number of hypertensive patients who are and are not at goal at months 1 and 6.

Subjects and methods:-

Study population

Jordanian patients with newly diagnosed or uncontrolled essential HTN with or without drug treatment (according to European Society of Hypertension/ European Society of Cardiology guidelines for the management of arterial hypertension ESC/ESH [7], and The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7) [8]) were enrolled by 40 sites across Jordan. This study was conducted from July 2013 to July 2014.

Methods:-

This was a prospective, observational, national study conducted by investigators from across Jordan. These investigators were identified from a list of potential investigators (from the national territory) who were involved in the disease management. The list included 52 investigators of whom, 40 accepted to participate in the study. According to the statistical sample size calculation, each center/ investigator was asked to enroll consecutive patients (5 to 10) who met all of the inclusion criteria and didn't meet any of the exclusion criteria after providing their written informed consent.

Patients above 18 years of age who had newly diagnosed or uncontrolled essential hypertension (ESC/ESH [7], and JNC 7 criteria [8]) and to whom the in the physician's judgment should be prescribed an antihypertensive therapy, were included in the study population eligible for statistical analysis. Patients with untreated or uncontrolled previously diagnosed essential hypertension (on fixed or free drug combination) were also enrolled. Patients who were pregnant or lactating had secondary hypertension or were participating in another study were excluded.

Uncontrolled HTN was defined as a blood pressure value of 140/90 mm/Hg or higher in hypertensive patients and 130/80 mm/Hg or higher in all hypertensive patients who have diabetes and/or chronic kidney disease.

This study was conducted in accordance with the principles of the 18th World Medical Assembly (Helsinki, 1964) and all subsequent amendments and the ICH-E6 Good clinical practice guidance was followed [9].An informed consent form was signed and dated (with a witness) from all participants.

Data collection:-

Data was collected using paper case report forms (CRFs) in English. It was the investigator's responsibility to fill in the CRF and to record all data. Data was collected at enrollment (baseline) and the physicians were asked to report updated participant data on a 6 months cycle. Data quality control (full source data verification) was performed by a qualified study monitor in 10% of the active sites (randomly chosen).

Data collected during baseline visit included: assessment of eligibility criteria, age, gender, weight, height, waist circumference, marital status, educational level, work status, health coverage, HTN history, family history, smoking habits, following a diet for weight loss, salt intake, level of physical activity, presence of co-morbidities, number of antihypertensive drugs, as well as blood pressure measurements.

Blood pressure measurement using a digital or manual device was acceptable. However, type of the device used was recorded in the CRF in order to assess the real-life practice. Body mass index (BMI) was calculated using the following formula: BMI (Kg/m^2) = weight (kg)/ the square of height (m) [10].

Data were collected at baseline (visit 0), 1 month (visit 1) and at 6 months (visit 2) cycles until the study concluded. During follow-up visits conducted around month 1 and 6, in addition to what has been collected during the baseline visit, investigator's perception of blood pressure control was assessed.

Statistical analysis:-

As per calculated sample size, 400 patients were required to estimate the percentage of target achievement at 6 months (assumed to be 50%), to within 3% with 95% confidence (considering a drop-out rate of 10%).

The primary endpoint of the study was an identification of factors affecting BP control at 6 months in all patients. Secondary endpoints included: factors affecting BP control at 1 month in all patients and those in the diabetic subgroup, in addition to the percentage of patients who reached the target at months 1 and 6.

Data was summarized using mean and standard deviation for continuous parameters while counts and percentages were calculated for categorical parameters. All statistical tests were performed using two-tailed tests at a 5% level of significance. Statistical significance was tested using the 2-sided Chi-square test, t-test, ANOVA methods or non-parametric tests as appropriate.

Demographic, socio-economic and clinical characteristics of study participants at baseline were summarized using descriptive statistics. Means and standard deviations or frequencies and percentages were used according to the type of data to be analyzed.

Predictors of blood pressure control/non-control at 1 month and 6 months were identified using multivariate logistic regression analysis models including factors that were found to affect significantly ($p<0.05$) blood pressure control (using univariate analysis). Odds ratio with its 95% confidence intervals was used to report the significance of risk factors' impact.

Demographic, physical, and socioeconomic predictors of blood pressure control/ non-control at one month and six months considered during the study included: age, BMI, waist circumference, Systolic blood pressure (SBP) and Diastolic (DBP) at baseline, gender, marital status, educational level, employment, health insurance coverage and family history of HTN. While behavioral and medical predictors included: smoking, salt intake, following a diet plan, physical activity level, being newly diagnosed or previously diagnosed with hypertension, combination therapy at baseline and one month, diabetes, Chronic kidney disease (CKD), dyslipidemia and early control of BP at one month. Subgroup analyses for BP control predictors in diabetic patients were carried out.

The mean values of systolic and diastolic blood pressures throughout study visits were compared using paired t-test ANOVA tests. Percentages of patients with controlled BP at 1 month and 6 months according to guidelines (with its 95% CI) and the percentages according to physician's perceptions were calculated. The level of agreement between physician’s perceptions of blood pressure control and guidelines was assessed. Interpretation of Kappa value was done according to Landis and Koch’s classification 1977 [11] (Table 1).

Table 1:- Interpretation of Kappa value to assess the level of agreement between physician’s perceptions of blood pressure control and guidelines [11]

Kappa	Agreement
< 0.00	Less than chance agreement
0.01 – 0.20	Slight agreement
0.21 – 0.40	Fair agreement
0.41 – 0.60	Moderate agreement
0.61 – 0.80	Substantial agreement
0.81 – 0.99	Almost perfect agreement

Data was analyzed using SPSS (Statistical Package for the Social Sciences) software, version 17 (SPSS Inc., Chicago, USA, version 17.0) [12].

Results:-

Recruitment:-

A total of 405 patients in 40 centers (private clinics distributed all over Jordan) were recruited in this study. Specialties of participating investigators included endocrinology, cardiology, internal medicine, general medicine and nephrology. Out of the 405 patients, 401 were eligible for the descriptive analysis, 381 were eligible for follow-up analysis at one month and 367 were eligible for follow-up analysis at 6 months. Reasons for patients' exclusion are listed in Figure 1.

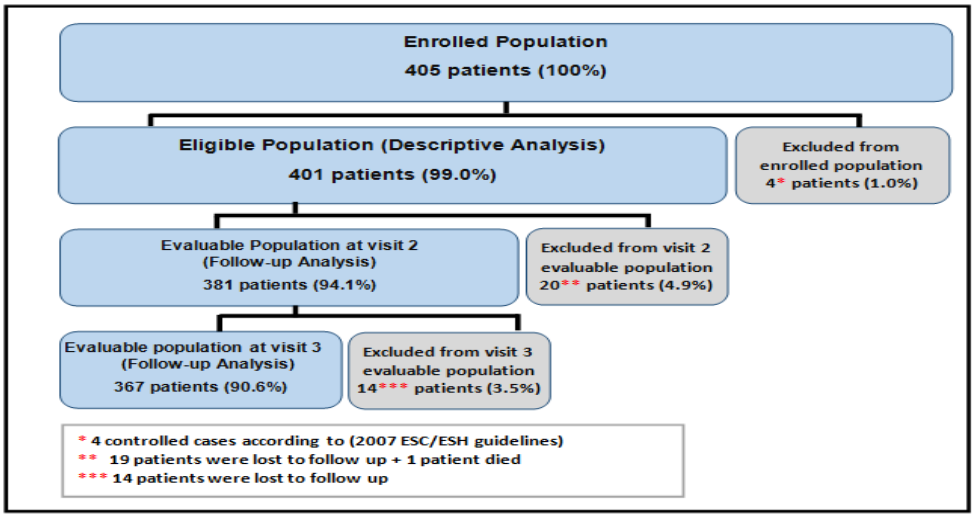

Fig 1:- Patient's disposition flowchart shows total number of enrolled patients and exclusion criteria

Socio-demographic characteristic at baseline:-

The eligible study population consisted of 401 (100%) patients. Table 2 illustrates their socio-demographic characteristics at baseline.

Table 2:- Socio-demographic characteristics of study population at baseline (N=401)

Variable	**Mean ± SD**
Age (years)	52.66± 11.85
Weight (kg)	86.61±14.44
BMI (kg/m^2)	30.31±4.76
Waist circumference (cm)	104.20± 13.80
Gender	**Percentage**
Male	52.87
Female	47.13
Marital status	**Percentage**
Currently married	83.29
Widowed	8.73
Never married	6.98
Divorced	0.99
Education level	
College/University	37.88
High school	33.59
Less than high school	22.98
Have not attended any formal schools	5.55
Work status	
Employed	51.62
Unemployed	36.16
Retired	12.22
Health insurance coverage	

Yes	**48.13**
Public Insurance	13.99
Private Insurance	81.35
Both	4.66
No	**51.87**

Behavioral measurements at baseline:-
Regarding smoking habits, results showed that a quarter of the population (101 patients, 25.19%) were smokers (the past and current) while 300 patients (74.81%) were non-smokers. For the current smokers, smoking duration (mean± SD) was 20.21± 11.72 years, and for the past smokers quitting duration was 8.70± 5.40 years.

Out of the 101 (100%) patients with smoking history, 72 (71.29%) were current cigarette smokers, 11 (10.89%) were former cigarette smokers and 18 (17.82%) never smoked cigarettes but used other forms of smoking.

Salt intake habits data collected from 369 patients indicated that 43.90% were reducing sodium intake to help control their blood pressure while 56.09% were not trying to cut down salt, While Dietary habits showed that (24.94%) of the population were on a weight loss diet at the baseline visit. In addition, physical activity level associated with patients' work was assessed and results showed low physical activity level in 39.15%, moderate in 8.23%, and vigorous in 1.00%, while (48.38%) were not working; activity level was reported as "unknown" in (3.24%) of the population.

Hypertension history:-
Almost half of the population (49.38%) was newly diagnosed while the other half (50.62%) was previously diagnosed with a mean± SD duration of 6.98± 5.71 years since firstly diagnosed. The majority of patients previously diagnosed with hypertension (95.07%) were on anti-hypertensive medications before enrollment in the study; 56.16% were taking one antihypertensive drug, 29.06% were taking two drugs, 7.88% were taking three drugs, and 1.97% were taking more than three antihypertensive drugs before inclusion in the study. The family history of hypertension was reported in 83.06% of the population. At the baseline visit, the mean± SD systolic blood pressure was 158.73± 14.64 mmHg and the mean± SD diastolic blood pressure was 97.27± 7.93 mmHg.

The majority of patients (75.56%) were using a manual device for blood pressure measurement, 21.19% were using a digital device, and 3.24% were using both manual and digital devices.

Documented Co-morbidities:-
Medical history data was analyzed and results showed that diabetes mellitus type 2 and hyperlipidemia were the most frequent co-morbidities, reported in 38.40% and 31.17%, respectively (table 3).

Table 3:- Documented Co-morbidities

Comorbidity	**Percentage**
No	**41.16**
Yes	**58.10**
– DM II	38.40
– Hyperlipidaemia	31.17
– Coronary Artery Disease	6.73
– Angina	4.24
– COPD	2.74
– Chronic Kidney Disease	2.74
– Myocardial Infarction	2.49
– Congestive Heart Failure	2.24
– Peripheral Vascular Disease	1.99
– Cerebral Vascular Accident	0.99

** Every subject may had more than one Documented Co-morbidity*

Primary Outcome:-
Predictors of blood pressure control in a Jordanian hypertensive population treated for 6 months according to ESC/ ESH - JNC 7 guidelines (N=367).

The percentage of patients with controlled BP after 6 months of treatment was 63.49% (CI = 58.5 to 68.4 p<0.001) as out of 367 evaluable patients, 233 patients had reached their targets. Moreover, Diabetes was associated with poor blood pressure control at one month (OR = 0.07, CI = 0.03 to 0.16) and at 6 months (OR = 0.09, CI = 0.03 to 0.27). In addition, early control of blood pressure at one month was associated with a better control at 6 months (OR= 13.88, CI = 5.21 to 36.98).

Notably, no significant association with blood pressure control was found for age, BMI, waist circumference, average SBP at baseline, educational level, employment or presence of co-morbidities(except for diabetes) (table 4).

Table 4:- Multivariate analysis of BP control predictors at 6 months (evaluable population), all statistical tests were performed using two-tailed tests at a 5% level of significance. Statistical significance was tested using the 2-sided Chi-square test, t-test, ANOVA methods or non-parametric tests as appropriate. (*) indicates statistical significance.

Variables	Odds ratio	95% CI (Lower – Upper)	P value
Age	0.96	0.93 - 1.00	0.06
BMI	0.97	0.88 - 1.07	0.63
Waist	0.99	0.96 - 1.03	0.83
SBP at baseline	0.98	0.96 - 1.01	0.25
Education level	0.90	0.39 - 2.08	0.81
Employment	0.59	0.24 - 1.35	0.21
Diabetes	**0.09**	**0.03 – 0.27**	**< 0.001***
Co-Morbidities	0.72	0.25 - 2.06	0.54
BP control at month 1	**13.88**	**5.21 – 36.98**	**< 0.001***

Secondary Outcomes:-
Predictors of blood pressure control in a Jordanian hypertensive population treated for one month according to ESC/ESH - JNC 7 guidelines (N=381):

The percentage of patients with controlled BP after one month was 40.94% (CI = 35.98 to 45.90) as out of 381 evaluable patients, 156 patients had reached their targets. Diabetes was a predictor of poor BP control at 1 month (OR = 0.07, CI = 0.03 to 0.16). In addition, high BMI (OR = 0.93, CI = 0.88 to 0.99), high DBP at baseline (OR = 0.95, CI = 0.91 to 0.99) and high SBP at baseline (OR = 0.96, CI = 0.93 to 0.98) were also associated with poor control.

No significant association with blood pressure control was found for age, education level, employment, and health insurance, following a diet, new diagnosis of hypertension, presence of co-morbidities or CKD (table 5).

Table 5:- Multivariate analysis of BP control predictors at 1 month (evaluable population), all statistical tests were performed using two-tailed tests at a 5% level of significance. Statistical significance was tested using the 2-sided Chi-square test, t-test, ANOVA methods or non-parametric tests as appropriate. (*) indicates statistical significance.

Variables	Odds ratio	95% CI (Lower – Upper)	P value
Age	0.99	0.97 – 1.02	0.62
High Education level	1.56	0.78 – 3.11	0.20
Employment	0.88	0.47 – 1.66	0.69
Health insurance	1.42	0.83 – 2.44	0.19
Following Diet	0.78	0.42 – 1.44	0.43
Newly Diagnosis of HTN	0.86	0.49 – 1.49	0.59
Co–morbidities	1.12	0.56 – 2.25	0.74
Diabetes	**0.07**	**0.03 – 0.16**	**< 0.001***
CKD	0.14	0.01 – 1.48	0.10
BMI	**0.93**	**0.88 – 0.99**	**0.03***

SBP at baseline	**0.96**	**0.93 – 0.98**	**< 0.001***
DBP at baseline	**0.95**	**0.910 – 0.99**	**0.02***

The number of hypertensive patients who are and are not at goal at one month and at six months according to ESC/ESH - JNC 7 guidelines:

The percentage of patients with controlled BP after 6 months is 63.49% (CI = 58.53 to 68.43, p<0.001) compared to (40.94% CI = 35.98 to 45.90)after 1 month of treatment. The level of agreement between guidelines (ESC/ESH – JNC7) and physicians' perceptions of blood pressure control showed a moderate agreement at the follow-up visit at month 1 (kappa = 0.44, p<0.001) while a fair agreement was shown at the follow-up visit at month 6 (kappa = 0.24, p<0.001). Interpretation of Kappa value was done according to Landis and Koch's classification.

Predictors of blood pressure control in the diabetic sub-group at month 1 according to ESC/ ESH - JNC 7 guidelines (N=147):

The predictors that were found to be associated with poor blood pressure control were combination therapy at baseline (OR = 0.22, CI= 0.07 to 0.74) and average DBP at baseline visit (OR = 0.92, CI = 0.84 to 0.99). And no significant association with blood pressure control was found for education level, following a diet or SBP at baseline. Details are provided in table 6.

Table 6:- Multivariate analysis of BP control predictors at month 1 (diabetic population), all statistical tests were performed using two-tailed tests at a 5% level of significance. Statistical significance was tested using the 2-sided Chi-square test, t-test, ANOVA methods or non-parametric tests as appropriate. (*) indicates statistical significance.

Variables	Odds ratio	95% CI (Lower – Upper)	P value
High Education Level	3.04	0.82 – 11.26	0.09
Following Diet	4.12	0.83 - 20.39	0.08
SBP at baseline	0.99	0.94 – 1.05	0.87
DBP at baseline	**0.92**	**0.84 - 0.99**	**0.049***
Combination therapy at baseline	**0.22**	**0.07 - 0.74**	**0.01***

Predictors of blood pressure control in the diabetic sub-group at 6 months according to ESC/ ESH - JNC 7 guidelines (N=141):

In the diabetic subgroup, the predictor found to be associated with poor blood pressure control at 6 months was old age (OR = 0.95, CI= 0.91 to 0.99). While blood pressure control at one month follow up visit and use of combination antihypertensive therapy at baseline and month 1 was found to be associated with good blood pressure control (OR = 55.71, CI= 9.56 to 318.11) and (OR = 5.01, CI= 1.09 to 24.60) respectively. No significant association with blood pressure control was found for average DBP at baseline (Table 7).

Table7:- Multivariate analysis of BP control predictors at month 6 (diabetic subgroup), all statistical tests were performed using two-tailed tests at a 5% level of significance. Statistical significance was tested using the 2-sided Chi-square test, t-test, ANOVA methods or non-parametric tests as appropriate. (*) indicates statistical significance.

Variables	Odds ratio	95% CI (Lower – Upper)	P value
Age	**0.950**	**0.91 - 0.99**	**0.033***
DBP	0.95	0.89 - 1.01	0.14
Combination therapy at baseline and month 1	**5.01**	**1.02 – 24.60**	**0.047***
BP control at month 1	**55.71**	**9.75 – 318.11**	**< 0.001***

Safety

This study was a disease registry, and safety data was collected upon spontaneous reporting of adverse drug reactions (ADRs). Investigators were required to comply with country regulations by reporting these events to the health authorities. Meanwhile, adverse drug reactions were not reported by the investigators during the study.

Discussion:-

BP control rates is the identification of factors that can affect/ predict blood pressure control, and understanding of those predictors can help provide special care to patients at a higher risk of poor control. Our study was designed to identify the main predictors of blood pressure control in a Jordanian hypertensive population treated for an average

of 6 months. In addition, identify these predictors at 1-month follow-up, identifying these predictors in the diabetic subgroup, evaluating BP control rates at one month and six months follow-up in addition to analyzing the agreement between guidelines and clinical real-life practice.

The study identifies diabetes as a predictor of poor blood pressure control in a hypertensive population at one month (OR = 0.07, CI = 0.03 to 0.16) and at 6 months follow-up (OR = 0.09, CI = 0.03 to 0.27). This is consistent with results from a previous study conducted on Lebanese patients where diabetes was associated with poor control of blood pressure in hypertensive patients (OR = 0.15, CI = 0.10 to 0.24) [13]. Results were also consistent with the study conducted by Majernick, et al (2004) were diabetes mellitus reduced the odds of BP control by 64% [14]. Yoon, et al (2012) suggested that prevalence of BP control was lowest among those with diabetes or CKD [15].
Hypertension is a common co-morbidity in patients who have type 1 or type 2 diabetes. Prevalence of hypertension among diabetic patients depends on patient's age, obesity, ethnicity, and type of diabetes while time course depends on to duration of diabetes [16-19].

The study results support the pathogenic link between diabetes and cardiovascular diseases. One of the mechanisms is that due to insulin deficiency or insulin resistance, patients with diabetes have decreased the bioavailability of NO which is a potent vasodilator in addition to increased secretion of endothelin-1 which is a vasoconstrictor. This leads to a state of vasoconstriction that has been found in patients with metabolic syndrome and those with diabetes [20, 21]. Platelet adhesion and platelet aggregation enhancement, lipoprotein abnormalities, endothelial dysfunction and vascular smooth muscle cell abnormalities are all explanatory mechanisms for the role of diabetes in hypertension and other cardiovascular disorders [22].

A cross-sectional study to identify the prevalence of diabetes type 2 in Jordan revealed an age-standardized prevalence of 17.1% [23]. This percentage could be considered high if compared to the global prevalence of diabetes which is 9% among adults aged more than 18 years [24]. It would be of a great value to control the blood glucose levels in this group of patients that will lead to less vascular complications and accordingly fewer mortality rates.

Benefits of early control of blood pressure were discussed in previous studies [13, 25]. Consistent results were obtained from our study whereas the early control of blood pressure at 1 month was associated with better control rates at 6 months in the total population (OR = 13.88, CI = 5.21 to 36.98) and the diabetic subgroup (OR = 55.71, CI= 9.75 to 318.11), respectively.

The BMI of current study patients at baseline visit was 30.31± 4.76 kg/m^2 (which is considered obese as per the National Heart, Lung and Blood Institute[26]).High BMI was associated with poor control of blood pressure at 1-month follow-up (OR = 0.93, CI = 0.88 to 0.99).

Hypertension is a common complication of obesity. About 30% of hypertensive patients can be classified as obese [27]. Recent studies have confirmed the beneficial effect of modest weight loss on blood pressure-lowering. Modest weight loss normalizes blood pressure even before reaching ideal weight. It can lower or even discontinue the need for using an antihypertensive medication. Accordingly, a modest weight loss is beneficial in patients with hypertension [28].

In the diabetic subgroup, use of combination therapy was associated with better blood pressure control rate at 6 months follow-up (OR = 5.01, CI= 1.02 to 24.60). This is consistent with previous studies that reported better control in patients prescribed combination therapy compared to those maintained on monotherapy [13, 29. 30].
There is evidence that reducing blood pressure from very high to moderate levels can reduce the cardiovascular risk (e.g. stroke) in older diabetic patients. In the current study, older age was associated with poor control of blood pressure at 6 months follow-up (OR = 0.95, CI= 0.91 to 0.99) in the diabetic subgroup [31].

A statistically significant reduction in mean systolic and diastolic blood pressure levels throughout the study visits compared to baseline was observed ($p<0.001$).

Study results have shown that after 6 months of treatment, the percentage of patients who achieved blood pressure target according to ESC/ESH – JNC 7 criteria (63.49%; 95 CI: 58.53%, 68.43%) was significantly higher ($p<0.001$)

than that at one month of follow-up visit, (40.94%; 95 CI: 35.98%, 45.90%). These control rates are considered comparable to those reported in a previous study performed on Lebanese patients [13].

Blood pressure control rates according to ESC/ESH - JNC 7 criteria were measured at 1 month and 6 months follow-up. In addition, physicians were asked if they consider the patients to have controlled or uncontrolled blood pressure at the same time intervals. The level of agreement between physician's perceptions of blood pressure control and JNC VII guidelines was assessed. Kappa agreement according to Landis and Koch's classification[11], which is universally accepted was calculated between the two variables.

Analysis of agreement between physicians' perception and guidelines regarding blood pressure control agreement showed fair agreement at 6 months follow-up visit ($p<0.001$, $K= 0.24$) and a moderate agreement at 1-month follow-up ($p<0.001$) ($K= 0.44$). Results of a study conducted to examine physicians' perceptions and their adherence to European guidelines showed, as in our study, a significantly low agreement between physicians' practice and the guidelines although the vast majority of the participating physicians reported that they were aware of hypertension guidelines and that they implement them in daily practice [32].
Barriers to guideline adherence may include awareness, familiarity, agreement, outcome expectancy and self-efficacy [33].

A study conducted to investigate the awareness, agreement, adoption, and adherence to hypertension guidelines in clinical practice revealed that lack of awareness about guidelines is seldom the problem and that high awareness doesn't necessarily mean high agreement and adoption [34].

The current study randomly selected sample is representative of the national population and provides insight into real-life settings suggesting some important predictive factors of poor blood pressure control such as diabetes and old age. Our collected data will permit planning and develop strategies to prevent, treat and control high blood pressure. Still, we were limited to small sample size (401 patients) with short-term follow-up period (6 months). In addition, enrollment of patients into the study based on physician preference could have introduced selection bias. However, the inclusion of consecutive patients may have avoided such selection.

Moreover, our analysis was done based on blood pressure measurements on a single occasion, both at the baseline and follow-up evaluation. Likewise, our study didn't investigate adherence to prescribed antihypertensive medications which is essential for the development of interventions that increase adherence rates. Finally, physician guideline adherence limits the generalizability of results. All of these factors related to poor blood pressure control are going to be assessed in future studies.

We conclude by revealing some factors as predictors of good blood pressure control while others were associated with lower control rates. Both categories can be targeted when managing patients with these characteristics to achieve higher control rates, better cardiovascular outcomes, and lower mortality.

Early control of blood pressure at 1 month was associated with better control rate at 6 months while diabetes mellitus was associated with lower rate. High BMI, SBP and DBP at baseline were associated with lower control rate at 1 month. Among diabetic patients, use of combination antihypertensive therapy and early control of blood pressure at 1 month were associated with better control rates at 6 months while older age was associated with lower control rate. The study also shows a gap between the knowledge of hypertension guidelines and their application in clinical practice. On the other hand, appropriate interventions should be considered to increase adherence of physicians to the guidelines.

Disclosure:-
The authors do not have any conflict of interest regarding this work.

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