Use of Opportunistic Screening for Hypertension and Diabetes among the Patients' Attendees in a Tertiary Care Hospital of Mangalore

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Abstract:

Introduction: Hypertension and Diabetes are two of the most common chronic non-communicable diseases and multifactorial disorders affecting both developed and developing countries. **Method:** A cross sectional study was conducted for a period of 3 months among patients' attendees above the age of 30 years in a tertiary care hospital of Mangalore, between July - September 2018. Data was collected from 150 patient attendees by personal interviews followed by anthropometry, blood pressure measurement and random blood sugar and entered into Microsoft excel. Analysis was done using Statistical package for social sciences (SPSS) software version 21. **Results:** It was seen that 72(48%) were Normotensive, 44 (29.3%) were Pre-hypertensive and 34 (22.7%) were Hypertensive while 65(43.3%) had a random blood sugar of > 140 mg/dl. There was an association between hypertension and age, gender, type of family, occupation, religion, alcohol intake, smoking habits and physical activity which was statistically significant (p< 0.05). While age more than 45 years, illiteracy, belonging to Christian faith, having a family history of diabetes mellitus and being obese/ overweight were associated with a random blood sugar of >140 mg/dl which was statistically significant (p< 0.05). It was also seen that 23(67.6%) of hypertensive attendees and 18(40.9%) of pre-hypertensive attendees also had diabetes as a comorbidity. **Conclusion:** Opportunistic screening of individuals for hypertension and diabetes will help in early detection of these diseases. This will help in early prevention and timely treatment.

Keywords: Diabetes, Hypertension, Opportunistic Screening, Prevalence.

Introduction:

Type 2 diabetes mellitus (DM) and Hypertension (HTN) are among the most common chronic non-communicable diseases and multifactorial disorders affecting both developed and developing countries.[1] Diabetes mellitus is the single most important metabolic disease recognized worldwide as one of the leading cause of death and disability. It has been estimated that presently in India 19.4 million individuals are affected by diabetes.[2] World Health Organization (WHO) has already declared India as the global capital of diabetes and has predicted number of diabetics to be nearly 80 million by2030.[2] On the other hand, prevalence of hypertension (HTN) among adults is expected to rise by 60% resulting in a total of 1.56 billion affected individuals by 2025.[3]

Approximately 70% of diabetics are hypertensive, as diabetics are prone to HTN twice more likely than normoglycemic individuals. Similarly, the presence of HTN precedes the onset of diabetes mellitus (DM).[3] The presence of hypertension in diabetic patients substantially increases the risks of coronary heart disease, stroke, nephropathy and retinopathy. Also the risk of cardio vascular disease is increased by 75%, which further contributes to the overall morbidity and mortality of an already high risk population.[4] Epidemiological and clinical studies have shown that these diseases often cluster in individuals and in families.[1]

Most of the people in India are not diagnosed and are left untreated which ranges from 30% and 80%, whereas 20%–30% are identified after developing macro- or micro-vascular complications. Poor public awareness and limited opportunities for diagnosis are the main reasons.[5] Diabetes is usually defined based on fasting or postprandial glucose. However, random capillary blood glucose (RCBG) is the most convenient way to reach large numbers of people.[6] Also population-based screening result in low yield thereby resulting in a higher cost as seen in few population-based screening studies.[5]

Therefore, this study was done to screen for hypertension and diabetes among the patient's attendees who accompany the patients coming to the hospitals. This type of opportunistic screening will help identify more number of cases as hypertension and diabetes usually cluster in families.

Method:

A Cross sectional study was conducted for a period of 3 months among patient attendees above the age of 30 years in a tertiary care hospital of Mangalore, between July - September 2018. Included in the study were those who were not already diagnosed with hypertension and diabetes. The attendees who did not give their consent were excluded from the study.

Sample size: Sample size was calculated to be 150 at 5% alpha error and using the prevalence of

hypertension in a previous study which was 40%.[7] Formula used to calculate was $4pq/l^2$, where p= prevalence, q=100-p, l is permissible error which was taken as 20% of P(relative precision).

Data collection: The study was conducted after getting the ethical committee approval. All the patients' attendees qualifying the inclusion criteria were interviewed till the sample size was reached. Data regarding socio-demographic profile, life-style and habitual behaviors (smoking and alcohol intake) were collected using a questionnaire previously validated in Indian subjects.

Anthropometry: Height, weight, waist, and hip circumference were measured using stadiometer, digital weighing machine and measuring tape, as per WHO international manual.

Body Mass Index(BMI) was calculated and classified as below[8]

Normal : 18.5-24.9

Overweight : 25.0 -29.9

Obesity : >30

Blood pressure measurement: It was done using sphygmomanometer and stethoscope. Blood pressure was measured in the left arm in a sitting posture before filling the questionnaires and subsequent 2nd reading was taken after 5 min of rest and 3rd reading was recorded after the completion of the questionnaires and final average reading was considered for analysis.

The classification of hypertension was done based on Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure 7(JNC 7).[9] Those who have systolic blood pressure >140 mmHg and/or diastolic blood pressure >90 mmHg were classified as hypertensive. Systolic blood pressure of 120-139 mmHg and or diastolic blood pressure of 80-89 mmHg were classified as pre-hypertensive.

Random blood glucose: It was measured using a glucometer. Blood for the test was collected by a

finger pin prick after cleaning the finger with an alcohol swab. Using the 2-hour plasma glucose >200 mg/dl criterion, the random capillary blood glucose (RCBG) cutoff point of 140 mg/dl gave the highest sensitivity and specificity.[6] Hence RBS >140mg/dl was taken as positive for diabetes screening.

Physical activity : WHO defines physical activity as any bodily movement produced by skeletal muscles that requires energy expenditure. Physical activity refers to all movement including during leisure time, for transport to get to and from places, or as part of a person's work. Popular ways to be active include walking, cycling, wheeling, sports, active recreation, and play.[10]

Statistical analysis: Data was entered in Microsoft excel and SPSS software version 21 was used for statistical analysis. The categorical variables were presented using frequency and percentages. Chi-square test was used to find the association between different variables. Multinomial logistic regression was performed to know the association between socio-demographic features and habits of study participants with blood pressure, whereas Binomial logistic regression was done to know the association between socio-demographic features and habits of study participants with the random blood sugar. $p < 0.05$ was considered as statistically significant value.

Results:

In this study 150 patient attendees were interviewed and it was seen that majority of them 97(64.7%) belonged to 30-45 years' age group, 82(54.7%) were males, 38(25.3%) had completed pre-university education while 16 (10.7 %) were illiterates. (Table1)

On assessing the risk factors among the study participants, it was seen that 8 (5.3%) reported that they were stressed up, 50(33.3%) had family history of hypertension and 44(29.3 %) had family history of diabetes. Alcohol consumption was seen in 30(20%) of the study participants and 14(9.3%) of study participants were smokers. (Table 2)

Table 1: Socio-demographic characteristics of study participants (n=150)

Socio-demographic characteristics		Frequency (%)
Age	30-45 years	97(64.7)
	46-60 years	49(32.6)
	61-75 years	4(2.7)
Gender	Female	68(45.3)
	Male	82(54.7)
Education	Illiterate	16(10.7)
	Primary	15(10.0)
	Middle and high	23(15.3)
	Pre-university	38(25.3)
	Graduate	37(24.7)
	Post graduate	21(14.0)
Occupation	Professional	8(5.3)
	Semi professional	51(34.0)
	Skilled	13(8.7)
	Semi-skilled	18(12.0)
	Unskilled	8(5.3)
	Unemployed	52(34.7)
Marital status	Married	132(88.0)
	Unmarried	12(8.0)
	Widow	2(1.3)
	Divorced	4(2.7)
Religion	Hindu	76(50.7)
	Muslim	56(37.3)
	Christian	18(12.0)
Type of family	Nuclear	24(16.0)
	Three generation	121(80.7)
	Joint	5(3.3)

On assessing the BMI of the study participants, 59 (39.3%) were overweight while 23 (15.3%) were obese. When asked about duration of physical activity, 67(44.7%) of the study participants mentioned that they are physically active for 30minutes-1hour every daywhile 57(38%) were active for 15-30 minutes. (Table 2)

Table 2: Distribution of the study participants based on the risk factors

Study variables		Frequency (%)
Presence of *	Perceived Stress	8(5.3)
	Family history of Hypertension	50(33.3)
	Family history of Diabetes	44(29.3)
Eating habits#	Vegetarian	33(22.0)
	Non vegetarian	115(76.7)
	Oily food	140(93.3)
	Fast food consumption	113(75.3)
	Eating outside	114(76.0)
Other habits*^	Alcohol consumption	30(20.0)
	Tobacco smoking	14(9.3)
BMI	Normal (18.5-24.9)	68(45.4)
	Overweight (25.0 -29.9)	59(39.3)
	Obesity (≥30)	23(15.3)
Duration of physical activity	15-30 minutes	57(38.0)
	30 minutes-1 hour	67(44.7)
	1-2 hours	26(17.3)

*Multiple options were selected by the study participants.
#Those consuming oil fried foods and fast foods twice a week were considered
^ Those consuming alcohol and smoked once a week

On classifying Hypertension according to the JNC-7 criteria, 72(48%) were Normotensive, 44 (29.3%) were Pre-hypertensive and 34 (22.7%) were Hypertensive. It was observed that 65(43.3%) had a random blood sugar of > 140 mg/dl. (Table 3)

It was observed that there was an association between hypertension and socio demographic variables like age, gender, type of family, occupation, and religion. Association was also observed with habits like, alcohol intake, smoking and physical activity duration and was statistically significant. (Table 4)

Multinomial regression was done to know the association of socio-demographic features and habits of study participants with blood pressure.

Table 3: Distribution of the study participants based on Blood pressure and Random Blood Sugar

Risk factors		Frequency (%)
Blood Pressure	Normal	72(48.0)
	Pre hypertensive*	44(29.3)
	Hypertensive**	34(22.7)
Random blood sugar	<140mg/dl	85(57.7)
	≥140 mg/dl	65(43.3)

*Systolic BP of 120-139 mmHg and Diastolic BP of 80-89 mmHg
** Systolic BP of >140 mmHg and Diastolic BP of >90 mmHg

Multinomial regression model was subdivided into Model 1(Normotensive vs Hypertensive) and Model 2 (Pre-hypertensive vs Hypertensive). Model 1 showed that age (46–75 years), gender (female), occupation (employment) and Model 2 showed that age (46–75 years), occupation (gainful employment) and smoking habit were associated with increased blood pressure and this was found to be statistically significant. In Model 1, it was observed that those > 45 years of age were 8 times, [Adjusted OR=8.20 (C.I.: 1.53, 43.72)] females were 7 times, [AOR=7.09 (C.I. :1.06, 47.28)] and those gainfully employed were 10 times, [OR=10.03 (C.I. :1.06, 94.45)] more likely to be have hypertension as compared to Normotensive individuals. Similarly, in Model 2, it was observed that those > 45 years of age were 8 times, [AOR=8.61 (C.I.: 1.64, 45.05)], those gainfully employed were 275 times, [AOR=275.56 (C.I.: 10.53, 7210.10)] and those who smoke were 12 times, [AOR=12.22 (C.I.: 1.31, 113.339)] more likely to be Hypertensive as compared to Pre-hypertensives. (Table 5)

It was observed that most of the study participants who were above 45 years age, illiterate, belonging to Christian faith, having a family history of diabetes mellitus, obese/overweight and those doing physical activity of 1- 2 hours duration were associated with a Random blood sugar of> 140 mg/dl which was statistically significant; those in the age group of 46-75 years were more than 5 times, OR=5.7 (C.I. 2.74, 11.86), Christians were more than 2 times,

Table 4: Association of blood pressure levels with socio demographic variables and habits of study participants

Study variables		Blood pressure			p value
		Normal n(%)	Pre-hypertension n(%)	Hypertension n(%)	
Age in years	30-45	53(54.6%)	30 (30.6%)	14 (14.4%)	0.004
	46 - 75	19 (35.8%)	14 (26.4%)	20 (37.7%)	
Gender	Male	60 (73.2%)	13 (15.9%)	9 (11%)	<0.0001
	Female	12 (17.6%)	31 (45.6%)	25 (36.8%)	
Education	Illiterate	12 (75%)	0	4 (25%)	-
	Literate	60 (44.8%)	44 (32.8%)	30 (22.4%)	
Type of family	Nuclear	4 (16.7%)	9 (37.5%)	11 (45.8%)	0.001
	Three generation/ joint	68 (54%)	35 (27.8%)	23 (18.3%)	
Occupation	Unemployed	33 (63.5%)	15 (28.8%)	4 (7.7%)	0.003
	Employed	39 (39.8%)	29 (29.6%)	30 (30.6%)	
Religion*	Hindu	42 (55.3%)	23 (30.3%)	11 (14.5%)	0.003
	Muslim	28 (50%)	14 (25%)	14 (25%)	
	Christian	2 (11.1%)	7 (38.9%)	9(50%)	
Family history of hypertension	No	47 (47%)	30 (30%)	23 (23%)	0.941
	Yes	25 (50%)	14 (28%)	11 (22%)	
Family history of diabetes	No	51 (48.1%)	30 (28.3%)	25 (23.6%)	0.875
	Yes	21 (47.7%)	14 (31.8%)	9 (20.5%)	
Alcohol intake	No	68 (56.7%)	30 (25%)	22 (18.3%)	<0.000
	Yes	4 (13.3%)	14 (46.7%)	12 (40%)	
Smoking	No	69 (50.7%)	41 (30.1%)	26 (19.1%)	0.005
	Yes	3 (21.4%)	3 (21.4%)	8 (57.1%)	
Physical activity duration	15-30minutes	35 (61.4%)	11 (19.3%)	11 (19.3%)	<0.0001
	30minutes-1hour	30 (44.8%)	27 (40.3%)	10 (14.9%)	
	1-2hours	7 (26.9%)	6 (23.1%)	13 (50%)	
BMI	Normal	34 (50%)	22 (32.4%)	12 (17.6%)	0.392
	Overweight / obese	38 (46.4%)	22 (26.8%)	22 (26.8%)	

*Fishers exact test

Table 5: Multinomial regression to know the association between socio-demographic features and habits of study participants with blood pressure

Variable (reference*)		Model 1				Model 2			
		Normotensive Vs hypertensive				Pre-hypertensive Vs hypertensive			
		Wald's test P value	Odds ratio	95% CI		Wald's test P value	Odds ratio	95% CI	
				Lower	Upper			Lower	Upper
Age in years (30-45*)		0.01	8.20	1.53	43.72	0.01	8.61	1.64	45.05
Gender (male*)		0.04	7.09	1.06	47.28	0.08	0.07	0.00	1.44
Education (illiterate*)		0.55	0.52	0.06	4.51	-	-	-	-
Occupation (unemployment*)		0.04	10.03	1.06	94.45	0.00	275.56	10.53	7210.10
Religion (Hindu*)	Muslim	0.21	5.59	0.37	84.67	0.10	5.96	0.71	50.11
	Christian	0.53	2.41	0.14	40.26	0.32	3.12	0.32	30.49
Type of family (three generation/ joint*)		0.05	0.17	0.03	1.04	0.42	2.11	0.34	13.01
Alcohol (yes*)		0.28	3.35	0.36	30.65	0.32	0.40	0.06	2.46
Smoking (yes*)		0.88	1.17	0.13	10.48	0.02	12.22	1.31	113.33
Physical activity duration (1-2hours*)		0.26	8.49	0.20	354.81	0.67	0.40	0.00	26.33
		0.07	6.56	0.82	52.30	0.05	11.13	1.00	123.29

*Reference variables and odds ratio is interpreted based on the reference variable.

OR=2.63 (C.I. 1.57, 4.39), those with a family history of diabetes were 3 times, OR=3.26 (C.I. 1.57, 6.79), overweight/obese were 2 times, OR=2.59 (C.I. 1.32, 5.08) and those physically active for 1-2 hours were 2 times, OR=1.97 (C.I. 1.23, 3.17) more likely to have Random blood sugar > 140 mg/dl. It was seen that illiterates were less likely to have elevated random blood sugar with OR=0.22 (C.I. 0.07, 0.71).

It was observed that when binomial logistic regression was applied and Adjusted OR (AOR) was derived, it was seen that age, religion, family history of diabetes, BMI and physical activity duration were found to be statistically significant after adjusting for other variables; those in 46-75 age group were more than 6 times, AOR= 6.67 (C.I. 2.41, 18.49), Christians were 3 times, AOR= 3.39 (C.I. 1.5, 7.63), those with Family history of diabetes were almost 4 times, AOR= 3.98 (C.I. 1.35, 11.7), overweight/obese were 2 times, AOR= 2.38 (C.I. 1.0, 5.66), and those physically active were 2 times, AOR= 2.25 (C.I. 1.16, 4.37) likely to have

random blood sugar > 140 mg/dl after adjusting for other variables.(Table 6)

It was also observed that 23(67.6%) of hypertensive attendees and 18(40.9%) of pre hypertensive attendees also had diabetes as a comorbidity.

Discussion:

Hypertension constitutes one of the important risk factors of non-communicable disease worldwide as per WHO. It is estimated that high blood pressure is the lone risk factor for more than 50% of cardiovascular diseases.[11] It is seen that about 10-30 % suffer from hypertension worldwide based on JNC 7 report, additionally about 50-60% people can improve their prognosis if they are able to lower the BP.[12] Studies have shown that an average reduction in blood pressure by about 2-3 mmHg among those with high normal BP would result in 20-25 % reduction in the incidence of hypertension.[13]

Table 6: Binomial logistic regression to know the association between socio-demographic features and habits of study participants with Random Blood Sugar

Variables		Random Blood Sugar		p value	Odds ratio (C.I.)	Adjusted odds ratio (C.I.)	p value
		<140mg/dl n(%)	≥140mg/dl n(%)				
Age	30-45years	69 (71.1)	28 (28.96)	<0.001	5.7(2.74, 11.86)	6.67(2.41, 18.49)	< 0.001
	46-75years	16 (30.7%)	37 (69.8)				
Gender	Female	39 (57.4%)	29 (42.6%)	0.877	0.95 (0.55, 1.82)	0.43(0.12, 1.50)	0.185
	Male	46 (56.1%)	36 (43.9%)				
Education*	Illiterate	4 (25%)	12 (75%)	0.014	0.22 (0.07, 0.71)	0.87(0.16, 4.63)	0.874
	Literate	81 (60.4%)	53 (39.6%)				
Occupation	Unemployed	26 (50%)	26 (50%)	0.231	0.66 (0.34, 1.23)	1.52 (0.47, 4.89)	0.484
	Employed	59 (60.2%)	39 (39.8%)				
Religion	Hindu	54 (71.1%)	22 (28.9%)	0.001	2.63 (1.57, 4.39)	3.39(1.5, 7.63)	0.003
	Muslim	26 (46.4%)	30 (53.6%)				
	Christian	5 (27.8%)	13 (72.2%)				
Type of family*	Nuclear	16 (66.7)	8 (33.3)	0.334	1.21 (0.56, 2.62)	2.49(0.8, 7.74)	0.115
	Three generation	65 (53.7)	56 (46.3)				
	Joint	4 (80)	1 (20)				
Family h/o HTN	Yes	31 (62%)	19 (38%)	0.386	0.72 (0.36, 1.44)	0.33(0.11, 1.0)	0.051
	No	54 (54%)	46 (46%)				
Family h/o DM	Yes	16 (36.4%)	28 (63.6)	0.002	3.26 (1.57, 6.79)	3.98(1.35, 11.7)	0.012
	No	69 (65.1%)	37 (34.9)				
Alcohol intake	Yes	16 (53.3%)	14 (46.7%)	0.680	1.18 (0.53, 2.64)	0.74 (0.17, 3.19)	0.680
	No	69 (57.5%)	51 (42.5%)				
Smoking	Yes	8(57.1)	6 (42.9)	0.970	0.98 (0.32, 2.97)	2.09 (0.36, 12.24)	0.412
	No	77 (56.6)	59 (43.4)				
BMI	Normal	47 (69.1%)	21 (30.9%)	0.005	2.59 (1.32, 5.08)	2.38(1.0, 5.66)	0.048
	Overweight/ Obese	38 (46.3%)	44 (53.7%)				
Physical activity duration	15-30minutes	41 (71.9%)	16 (28.1%)	0.011	1.97 (1.23, 3.17)	2.25(1.16, 4.37)	0.017
	30minutes-1hour	33 (49.3%)	34 (50.7%)				
	1-2hours	11 (42.3%)	15 (57.7%)				

*Fisher exact test value

Out of the total 150 people screened in the present study, 22.7% patients were newly diagnosed hypertensives and 29.3% were having pre-hypertension. A large community-based survey done by Rao etal[11] with respondents aged ≥ 30 years in rural Karnataka found the prevalence of pre-hypertension to be 43.3%. Another study done by Anindo Majumdar etal[14] in Puducherry found that 17.9% and 37.7% had pre-hypertension and hypertension respectively. In the present study 11%

males and 36.8 % females had hypertension. In the study done by Anindo Majumdar et al[14] 64.3% males had hypertension.In our study, 40% individuals who consumed alcohol had hypertension which was almost similar to the study done by Anindo Majumdar et al[14] wherein 27% with prehypertension and 31% with hypertension consumed alcohol. Overweight/obesity (BMI>25) was a risk factor in our study with 26.8 % of them having hypertension and the finding was much lower than the study done by Anindo Majumdar et al[14] where 63.03% study participants with a BMI of more than 25 had hypertension. Advancing age, female gender, illiteracy, belonging to a nuclear family, employment status, belonging to Christian faith, indulging in habits of smoking, alcohol intake and increased physical activity duration were identified as significant correlates in our study based on multivariate analysis. This is in conformity with other studies done in India and overseas.[1,4,10,11,15]

Random Blood Sugar (RBS)of ≥140mg/dl was taken as cut off to screen for diabetes. Inthe present study, 43.3 % were screened to be positive for diabetes. A Study done by Anindo Majumdar et al[14] showed that 17.3% were diagnosed with diabetes. A study done to screen diabetes using public health system by Selvavinayagam TS[15] showed that 4.27% had diabetes. This low prevalence might be because this study was done on a large scale which included 35 million populations and was done in the community. Risk prediction strategies followed by targeted screening with blood sugar could have increased the proportion of diabetes individuals in such studies.[5] Opportunistic screening is a good way to detect high blood sugar patients early so that such patients would be prevented from going into micro and macro vascular complications which would lead to a huge economic burden in the complications management There is strong evidence from studies done in UK to carry out opportunistic screening every five years for people older than 40 years and yearly if there are risk factors suggestive of diabetes. Such screening would help identify most of the cases in the community providing a strong rationale to undertake such opportunistic screening.[16]

In our study 42.9 % of smokers had diabetes whereas in the study done by Anindo Majumdar et al[14]17.9 % were smokers who had diabetes. In a study done by Venugopal V et al,[5] 21% were current tobacco users.

In present study 53.7 % individuals who were obese had diabetes which was similar to the study done by Anindo Majumdar et al[14] where 46.2% of obese had diabetes as well as Venugopal V et al,[5] which had 54.3 % overweight/obese.

Conclusion:

The present study showed that 43.3 % of patient attendees had RBS level more than140mg/dl while 22.7% patients were newly diagnosed with hypertension and 29.3% were found to have pre-hypertension. On classifying hypertension based on JNC-7 criteria, it was seen that more than half of the study participants were either prehypertensive or hypertensive which in itself is a risk factor for diabetes as there was a statistically significant association between hypertension and random blood sugar levels.

Opportunistic screening of individuals for Hypertension and diabetes will help in early detection of disease and in identifying of risk factors along with saving of resources like money, materials, manpower and time that gets wasted in community survey.

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