Prevalence and predictors of adult hypertension in an urban eastern Indian population

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ABSTRACT

Objective To determine the prevalence of hypertension and to identify predictors of adult hypertension specifically in an underdeveloped urban region of eastern India.

Study design Population-based cross-sectional study, with multi-stage random sampling technique.

Settings A main urban city located in South Orissa in eastern India.

Participants 1178 adults 20—80 years of age randomly selected from 37 electoral wards of an urban locale.

Statistical methods Descriptive and multivariable logistic regression analyses.

Results The prevalence of hypertension was 36%. Significant predictors of hypertension were age, central obesity, inadequate fruit intake, diabetes, low high-density lipoprotein level and physical inactivity.

Conclusions One-third of the adults in this urban population of eastern India are reported to be hypertensive and the classical risk factors have been found to contribute to the increased burden, which reinforces the importance of preventive cardiovascular interventions in tackling this burden.

INTRODUCTION

Hypertension is a major public health concern in India and in other parts of South Asia.[1–4] Recent studies[5 6] have shown an increasing prevalence of adult hypertension both in urban and in rural regions of India. In 2000, 60.4 million men and 57.8 million women in India were estimated to have hypertension, and these numbers have been projected to increase to 107.3 and 106.2 million, respectively, by 2025.[7] Hypertensive subjects are known to have a twofold higher risk of developing coronary heart disease (CHD), four times higher risk of congestive heart failure and seven times higher risk of cerebrovascular disease and stroke compared with normotensive subjects.[8] Hypertension has been identified as one of the leading risk factors for mortality and is ranked as the third leading cause of disability-adjusted life-years.[9] Twenty-four per cent of all deaths due to CHD and 57% of all deaths due to stroke in India are estimated to be directly related to hypertension.[10]

Studies carried out worldwide to determine the risk factors for hypertension have reported that the increased risk of hypertension can be attributed to both behavioural and cardiometabolic risk factors such as excessive alcohol intake, smoking, physical inactivity, high fat/salt intake, overweight, obesity, diabetes and dyslipidaemias.

Published data suggest that the prevalence of hypertension has remained stable or has decreased in economically developed countries during the past decade, while it has increased in developing countries.[11] However, the increase in the prevalence rates of hypertension in developing countries needs to be quantified so that effective prevention strategies that are urgently needed can be developed. Given the rising prevalence of hypertension in developing countries like India, which are undergoing epidemiological transition, increased awareness, treatment and control of high blood pressure are critical to the reduction of cardiovascular disease (CVD) risk and prevention of the associated burden of illness.[12] Precise and dependable information about the epidemiology of hypertension across the Indian subcontinent is imperative to design suitable national health policies for its prevention and control. There is a strong correlation between changing lifestyle factors and the increase in hypertension in India. Epidemiological studies have shown that hypertension is present in 25% and 10% of the urban and rural population in India.[13]

In 2010, we reported a 10% prevalence of CHD in eastern India.[14] However, detailed information on changing lifestyle factors significantly predicting hypertension from urban populations in eastern India is lacking. Hence, this cross-sectional study was undertaken to identify the predictors of adult hypertension.

METHODS

The sample study population was chosen using a multi-stage random sampling technique. The sampling frame constituted 37 electoral wards spread across the urban population of Berhampur city in eastern India. A total of 1178 subjects who are ≥20 years of age were finally recruited for this study. Details are explained elsewhere.[14] In brief, demographic, socio-economic, self-reported behavioural information (smoking, alcohol intake, physical activity and diet), objective measures of anthropometry (height, weight, waist and hip circumferences), biochemical (plasma glucose, total cholesterol, triglycerides and high-density lipoprotein cholesterol levels) and ECG readings were collected. Hypertension in adults aged ≥18 years was defined as systolic blood pressure of ≥140 mm Hg and/or diastolic blood pressure of ≥90 mm Hg or any level of blood pressure in patients taking antihypertensive medication.[15 16]

Significant differences in proportions of potential lifestyle factors by hypertension status were estimated using Pearsons' χ^2 test. Univariate logistic regression and multivariable logistic regression analyses were performed using SAS software V.9.1.2 to predict potential significant predictors of hypertension using the backward elimination modelling technique.

Table 1 Prevalence of hypertension across different age groups

Age group (years)	Male (N=227) 38.5%	Female (N=204) 34.7%	Total
20–30	10 (55.6)	8 (44.4)	18 (4.2)
31–40	19 (38.0)	31 (62.0)	50 (11.6)
41–50	56 (48.7)	59 (51.3)	115 (26.7)
51–60	72 (54.5)	60 (45.5)	132 (30.6)
61–70	47 (57.3)	35 (42.7)	82 (19.0)
71–80	23 (67.6)	11 (32.4)	34 (7.9)

RESULTS

The overall prevalence of objective hypertension was 36.6%, which was higher in men (38.5% in men vs 34.7% in women). The prevalence of self-reported hypertension was 26.4%. Furthermore, the study showed that a large proportion (60.5%) of the population was pre-hypertensive. Pre-hypertension rates are also higher in men (62.4%; n=368/590) than in women (58.7%; n=345/588). Table 1 shows the gender-wise prevalence of hypertension across different age groups.

Similarly, the clinical and demographical characteristics of the study population are shown in table 2, the results of the univariate analysis revealing the risk of hypertension are summarised in table 3 and the significant predictors of hypertension in this population are summarised in table 4.

DISCUSSION

This study estimated that more than one-third of the urban population in eastern India is hypertensive, although the estimated self-reported hypertension is lower. All the known classical risk factors for hypertension—age, central obesity, fruit intake, diabetes, high-density lipoprotein level and physical inactivity—were found to be significant predictors of

Table 3 Results of univariate analysis revealing the risk correlates of hypertension

	n (%)	Hypertension OR (95% CI)	p Value
General obesity			
Yes (n=516)	249 (48.3)	2.46 (1.92 to 3.13)	0.000**
No (n=662)	182 (27.5)		
Central obesity			
Yes (n=576)	290 (50.3)	3.31 (2.58 to 4.25)	0.000**
No (n=602)	141 (23.4)		
Physical activity			
No (n=400)	205 (51.3)	2.56 (2.00 to 3.29)	0.000**
Yes (n=778)	226 (29.0)		
Smoking			
Yes (n=320)	109 (34.1)	0.86 (0.651.12)	0.272
No (n=858)	322 (37.5)		
Fruit intake			
No (n=721)	289 (40.1)	1.48 (1.15 to 1.90)	0.002**
Yes (n=457)	142 (31.1)		
Diabetes			
Yes (n=185)	121 (65.4)	4.16 (2.99 to 5.80)	0.000**
No (n=993)	310 (31.2)		
Hypercholesterolaemia			
Yes (n=273)	109 (39.9)	1.20 (0.911 to 1.58)	0.191
No (n=905)	322 (35.6)		
Hypertriglyceridaemia			
Yes (n=444)	214 (48.2)	2.21 (1.73 to 2.83)	0.000**
No (n=734)	217 (29.6)		
High low-density lipoprotein			
Yes (n=265)	78 (29.4)	0.66 (0.49 to 0.89)	0.006**
No (n=913)	353 (38.7)		
Low high-density lipoprotein			
Yes (n=553)	222 (40.1)	1.33 (1.05 to 1.69)	0.017*
No (n=625)	209 (33.4)		

Table 2 Clinical and demographical characteristics of study subjects

Variable	Normotensive subjects (n=747)	Hypertensive patients (n=431)	p Value
Age (years), mean (SD)	41.61 (13.18)	53.38 (12.05)	0.000**
Sex			
Male	363 (48.6)	227 (52.7)	0.178
Female	384 (51.4)	204 (47.3)	
Education			
Illiterate	50 (11.1)	83 (11.6)	0.159
Elementary	123 (22.9)	171 (28.5)	
High school	106 (27.4)	205 (24.6)	
College	152 (38.6)	288 (35.3)	
Socio-economic status			
Lower	129 (17.3)	52 (12.1)	0.039*
Middle	551 (73.8)	331 (76.8)	
Upper	67 (9.0)	48 (11.1)	
Smoking	211 (28.2)	109 (25.3)	0.272
Physical inactivity	195 (26.1)	205 (47.6)	0.000**
Low/no fruit intake	432 (57.8)	289 (67.1)	0.002*
Family history of hypertension	234 (31.3)	145 (33.6)	0.412
Diabetes (history or fasting blood sugar ≥126 mg/dl or PGBS ≥200 mg/dl)	64 (8.6)	121 (28.1)	0.000**
General obesity body mass index ≥25 kg/m^2	267 (35.7)	249 (57.8)	0.000**
Central obesity (waist circumference: men ≥90 cm, women ≥80 cm)	286 (38.3)	290 (67.3)	0.000**
Hypercholesterolaemia ≥200 mg/dl	164 (22.0)	109 (25.3)	0.191
Hypertriglyceridaemia ≥150 mg/dl	230 (30.8)	214 (49.7)	0.000**
High low-density lipoprotein ≥130 mg/dl	187 (25.0)	78 (18.1)	0.006**
Low high-density lipoprotein (men <40 mg/dl, women <50 mg/dl)	331 (44.3)	222 (51.5)	0.017*

Numbers in parenthesis indicate percentages.
*p<0.05, **p<0.01.
PGBS, post glucose blood sugar.

Table 4 Significant predictors of hypertension in the study population (backward elimination logistic regression modelling)

Variables Overall (n=431)	Adjusted ORs (95% CIs)
Age	
<45 years	Reference
45–64 years	3.63 (2.69 to 4.88)
>64 years	5.07 (3.24 to 7.93)
Central obesity	
Obese	2.32 (1.76 to 3.08)
Fruit intake	
Inadequate intake	1.38 (1.04 to 1.84)
Diabetes	
Diabetic	2.03 (1.40 to 2.96)
Abnormal high-density lipoprotein	
Yes	1.33 (1.01 to 1.75)
Physical activity	
No activity	1.81 (1.35 to 2.41)

hypertension in the present study. However, published reports suggest that the association between predictive risk factors and the risk of hypertension varies considerably in different populations across the country. An earlier study from South India revealed that age, body mass index, smoking, serum cholesterol and triglycerides are strongly associated with hypertension.[12] Similarly, increasing age, body mass index, waist to hip ratio, impaired glucose tolerance and diabetes were strongly associated with hypertension in a North Indian population.[17]

There are multiple, single-centre studies on the prevalence of hypertension that are available from across the country (see table 5. However, there are no multicentric national prevalence data. A review of various epidemiological studies published from India over the last five decades shows that the prevalence of hypertension has progressively increased, particularly in the urban areas, which suggests that hypertension is now a major health problem in India. The majority of these studies have methodological limitations; for instance, different examination techniques, varying diagnostic criteria and screening only blood pressure values to define hypertension.[26] The fact that hypertension is a major health problem in our country calls for large, nationwide, multicentric, prospective and supervised epidemiological studies.[27]

Table 5 Hypertension prevalence studies across urban India

Author	Year of publication	Age group (years)	Place	Sample size	Prevalence
Joseph A *et al*[18]	2000	20–89	Trivandrum, South India	206	37.4%
Anand *et al*[19]	2001	28–65	Mumbai, West India	1653	26.9
Gupta *et al*[20]	2002	20–75	Jaipur, North India	1123	37%
Shanthirani *et al*[21]	2003	≥20	Chennai, South India	1262	21.1%
Gupta *et al*[22]	2004	18–60	Mumbai, West India	88 653	48%
Das *et al*[23]	2005	≥18	Malda, East India	1609	24.9%
Reddy *et al*[24]	2006	20–69	Multi-centre	10 442	27.7%
Mohan *et al*[12]	2007	20–80	Chennai, South India	2350	20%
Latheef *et al*[25]	2007	≥20	Tirupathi, South India	1519	26.06%
Yadav *et al*[17]	2008	≥30	Lucknow, North India	1112	32.2%
Present study	2011	20–80	Berhampur, East India	1178	36.6%

The cross-sectional design used in the present study has methodological limitations. However, the objective measurement of many of the potential covariates that contribute to hypertension is an added advantage of this study. In addition, the multi-stage sampling technique minimises selection bias. Nevertheless, unknown/unmeasured risk factors might have introduced residual confounding.

CONCLUSION

Hypertension continues to be a public health and clinical burden that needs a realistic management protocol. A strong national surveillance system along the lines of the WHO STEPS (stepwise approach to chronic disease risk factor surveillance) programme needs to be rolled out nationwide to monitor cardiovascular risk factors. As hypertension is not a disease, but a condition that increases the risk of developing CVD, its long-term control is a continuing challenge. Health policy planners, physicians and public health experts should formulate region-specific guidelines based on local healthcare priorities and economic realities, including emphasis on lifestyle modification at all levels. Much of the underachievement of blood pressure control nationwide has been attributed to patients' unwillingness to take pills and their lack of adherence to follow-up visits.[12] However, health professionals and the healthcare system in place can also contribute to inadequate blood pressure control.[28]

The present study adds to the body of evidence that classical risk factors continue to contribute to increasing rates of adult hypertension, thereby underpinning the importance of preventive cardiovascular interventions in tackling the burden of hypertension. In addition, hypertension control requires a long-term commitment from the patient, the physician and the healthcare system. When all of them work together, the benefits of hypertension therapy in clinical trials can be easily and effectively translated into practice. This will eventually reduce the burden of CVD that was formerly associated with untreated or undertreated elevated blood pressure. It is unfortunate that although effective preventive measures exist, we are yet to achieve meaningful health and social gains because of the lack of organised preventive cardiovascular interventions.

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