Research Article

Pre-operative hypertension and its risk factors: A cross-sectional study among patients admitted for surgery at a tertiary health care facility of Eastern India

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ABSTRACT

Background: Hypertension (HTN) is one of the most common diagnoses in a primary health care setting and it is one of the important and preventable contributors to disease and death. HTN is considered as an additional risk factor in anesthesia and HTN is of special importance to the anesthetist for various reasons. Tracheal intubation, surgical incision, recovery from anesthesia, and post-operative pain can increase blood pressure (BP). **Objectives:** This study aims to find out the burden of pre-operative HTN and its risk factors among patients who were admitted for surgical procedures at a tertiary health care facility of Durgapur, West Bengal, India. **Materials and Methods:** After obtaining permission from the Institutional Ethics Committee, an institution based, observational, and cross-sectional study was conducted from January 2019 to February 2019. A pre-tested, semi-structured schedule was used to collect Clinic Social data. Anthropometric measurements and BP were taken as per the world health organization STEPwise approach to surveillance guidelines. BP was classified as per "The eighth joint national committee (JNC-8) guidelines. **Results:** Data were collected from 150 study subjects and were analyzed using SPSS, version 20.0 for windows. The frequency of pre-operative HTN and pre-HTN was found to be 38.0% and 32.0% respectively. As per JNC-8, 34.7% had Stage-1 HTN followed by 32.0% and 3.3% who had pre-HTN and Stage-2 HTN, respectively. Increasing age, male gender, smoking, increasing body mass index, dyslipidemia, and Type 2 diabetes mellitus (T2DM) were significantly associated with a higher frequency of HTN. **Conclusion:** There is a very high prevalence of pre-operative HTN and pre-HTN. Increasing age, male gender, smoking, overweight, obesity, dyslipidemia, and T2DM were significant risk factors for HTN. Routine screening of HTN should be done in surgical ward to see if there are cases of "white coat" HTN.

KEY WORDS: Pre-operative Hypertension; Hypertension; Pre-hypertension; World Health Organization – STEPwise Approach to Surveillance; Joint National Committee-8

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INTRODUCTION

Hypertension (HTN) is one of the most common diagnosis in a primary health care setting and it is one of the important and preventable contributors to disease and death.[1] While HTN is a well-established risk for adverse cardiovascular events, renal failure, retinal changes, etc., other blood

pressure (BP) anomalies may also impact health negatively. Pre-HTN may lead to overt HTN;[2] hypotension may cause dizziness, lightheadedness or in extreme condition may cause shock.[3]

Although the incidence of these complications may be reduced by adequate BP control, achieving good pressure control, especially at the community level is challenging.[4] HTN is considered as an additional risk factor in anesthesia and HTN is of special importance to the anesthetist for various reasons. Tracheal intubation, surgical incision, recovery from anesthesia, and post-operative pain can increase BP.[5] The increase in BP is more profound in patients who have pre-operative untreated or inadequately treated HTN.[6] While pre-operative HTN was associated with 4 times higher death due to cardiovascular complications within 30 days of anesthesia and surgery,[7] overzealous attempts to bring down the BP may result in a delay in surgery as well as may also jeopardize the organ perfusion in susceptible patients.[8] Multiple stress factors in surgical patients such as infection, trauma, and intraoperative manipulation further complicates the work of anesthetist.[9] Since BP of patients coming to the hospital for surgery might be elevated for various reasons such as poor sleep due to a new environment, surgery-related stress and anxiety, it will be inappropriate to label patients newly diagnosed or poorly controlled HTN based on BP recording from pre-assessment clinics. However, BP reading in a medical setting may be used in diagnosing "white-coat" HTN which is being seen in about 55% of people with Grade-I HTN but only in about 10% of people with severe HTN.[10] Pre-operative BP assessment may have the potential to unmask "white-coat" HTN and consequently may change the anesthetic and surgical manipulation as well as their outcomes. People having diagnosed with pre-operative HTN may be advised to meet their physician regularly after discharge and to lead a healthy lifestyle in the future. While there are many prevalence studies on the HTN in a community setting, the same is very few among pre-operative patients across India, and there is none in the Paschim Bardhaman district of West Bengal, India. This study aims to find out the burden of pre-operative HTN and its risk factors among patients who were admitted for surgical procedures at a tertiary health care facility of Durgapur, West Bengal, India.

MATERIALS AND METHODS

Study Setting

This study was conducted at surgical ward of IQ City Medical College and Multispecialty Hospital, Durgapur, India.

Study Type

This study was a institution based and observational.

Study Design

This was a cross-sectional study.

Study Period

This study was conducted from January 2019 to February 2019.

Study Duration

This study duration was 2 months.

Study Population

Adult patients admitted for elective surgical procedures at IQ City Medical College and Multispecialty Hospital, Durgapur, India.

Inclusion Criteria

Greater than 18 years, surgical procedure requiring general and regional anesthesia, surgical procedures requiring either pre-operative hospitalization.

Exclusion Criteria

Patients on steroids, chronic liver failure, chronic kidney disease stage 3B onward (Estimated glomerular filtration rate <45), emergency operative procedures were excluded from the study.

Sample Size

The sample size was 150.

Sampling Technique

The sampling technique was non-probability, consecutive.

Study Tool

a) Pre-designed, pre-tested, semi-structured schedule
b) Relevant medical records.

Operational Definitions

1) BP classification[1]
   a) Normal: Systolic BP (SBP) <120 mm of Hg and diastolic BP (DBP) <80 mm of Hg
   b) Pre HTN: SBP 120–139 mm of Hg or DBP 80–89 mm of Hg
   c) Stage-1 HTN: SBP 140–159 mm of Hg or DBP 90–99 mm of Hg
   d) Stage-2: SBP ≥160 mm of Hg or DBP ≥100 mm of Hg.

2) Body mass index (BMI) classification[11]
   a) Normal BMI: 18.5–24.99 Kg/m^2
   b) Overweight: BMI 25.00 Kg/m^2–29.99 Kg/m^2
   c) Obese: BMI ≥30 Kg/m^2.

Outcome Variables

a) Frequency of pre-operative HTN among study subjects
b) Factors associated with pre-operative HTN.

Study Technique

Study was started after getting permission from the Institutional Ethics Committee of IQ City Medical College and Multispecialty Hospital. Written informed consent was taken from all study participants. Relevant medical records were reviewed to collect data regarding Clinic Social data and past medical records of study subjects. BP was recorded on the day of surgery before going to the operation theater. Three BP measurements were taken from all study participants using mercury sphygmomanometer following the world health organization (WHO) STEPwise approach to surveillance guidelines. All readings were taken by a single observer and using a single sphygmomanometer. The first reading was discarded and average of the past two readings was taken for analysis.[12] BP was classified as per the Eighth Joint National Committee (JNC-8) guidelines.[1] Anthropometric measurements were taken as per the standard WHO protocols.[11]

Statistical Analysis

Data were codified and analyzed using Statistical Package for the Social Sciences for windows (SPSS, version 20.0). Frequency of HTN and other Clinic Social variables was calculated. Pie chart and simple bar diagrams were used to show frequency, pattern, and classification of HTN, respectively. Chi-square test was used to show the association between categorical variables. All statistical tests were two-tailed and $P < 0.05$ was considered significant.

RESULTS

Clinico-social characteristics of the study subjects are listed in Tables 1 and 2. Mean age of the study population was 41.81 ± 12.75 years. Mean BMI, mean systolic, and diastolic pressure were 23.42 ± 3.16 Kg/m^2, 131.0 ± 14.05 mm of Hg, and 79.42 ± 8.33 mm of Hg, respectively [Table 1]. About 73 (48.7%) of the study subjects were in the age group of 20–40 years, followed by 65 (43.3%) and 12 (8.0%) who were in age groups of 41–60 years and ≥61 years, respectively [Table 2]. The study population had female preponderance that constituted 56.0% of the study population. About 123 (82.0%) of them were Hindus and 27 (18.0%) were Muslims. About 39.3% of study subjects were educated up to Class VI-X followed by 31.3% and 22.0% who had education up to >Class X and Class V, respectively. About 7.3% of them were illiterate [Table 2]. About 65 (43.3%) of the study subjects were a current smoker. While 93 (62.0%) of the study subjects had normal BMI, 46 (30.7%) and 11 (7.3%) had their BMI in overweight and obesity range, respectively [Table 2]. About 22 (14.7%), 33 (22.0%), and 38 (25.3%) of the study subjects were known cases of Type 2 diabetes mellitus (T2DM), dyslipidemia, and HTN, respectively [Table 2]. About 45 (30.0%) of them had normal BP while 48 (32.0%) and 57 (38.0%) had pre-HTN and HTN, respectively [Table 2 and Figure 1]. Among hypertensive study subjects 32 (21.3%) had isolated systolic HTN, 4 (2.7%) had isolated diastolic HTN, and 21 (14.0%) had both systolic and diastolic HTN [Table 2 and Figure 2]. As per JNC-8 classification 52 (34.7%) had Stage-1 HTN followed by 48 (32.0%), 45 (30.0%), and 5 (3.3%) who had pre-HTN, normal BP, and Stage-2 HTN, respectively [Table 2 and Figure 3]. Increasing age and male gender were found to be significant non-modifiable risk factors for HTN. Smoking and increasing BMI were found to be a significant modifiable risk factor for HTN. A significantly higher proportion of HTN was found among diabetic and dyslipidemia study population [Table 3].

Table 1: Descriptive statistics of continuous variables among study subjects (*n*=150)

Variables	Minimum	Maximum	Mean±Standard deviation
Age (years)	20	84	41.81±12.75
BMI (Kg/m^2)	13	33	23.42±3.16
SBP (mm of Hg)	100	180	131.03±14.05
DBP (mm of Hg)	60	100	79.42±8.32

BMI: Body mass index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure

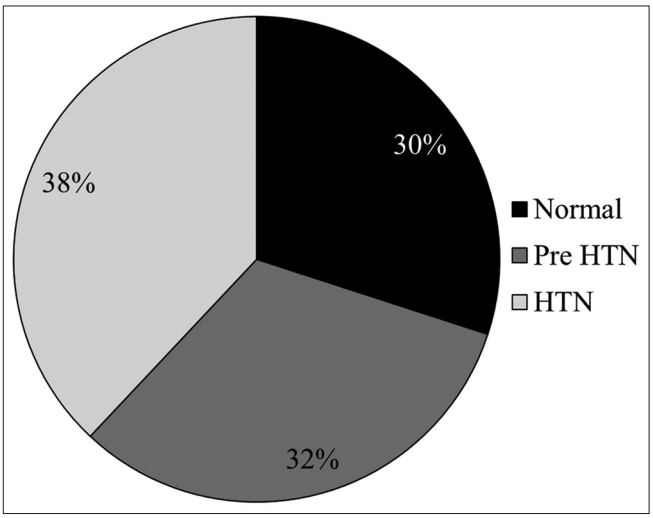

Figure 1: Simple pie diagram showing frequency of pre-operative hypertension and pre-hypertension among study subjects (*n* = 150)

Table 2: Clinico-social characteristics of study subjects (*n*=158)

Clinico-social characteristics	*n* (%)
Age group (years)	
20–40	73 (48.7)
41–60	65 (43.3)
≥61	12 (8.0)
Sex	
Male	66 (44.0)
Female	84 (56.0)
Religion	
Hindu	123 (82.0)
Muslim	27 (18.0)
Educational status	
Illiterate	11 (7.3)
Up to Class V	33 (22.0)
Class VI–X	59 (39.3)
>Class X	47 (31.3)
Current smokes	
Yes	65 (43.3)
No	85 (56.7)
BMI (Kg/m^2)	
Normal (18.5–24.99)	93 (62.0)
Overweight (25.00–29.99)	46 (30.7)
Obese (≥30.00)	11 (7.3)
K/C/O* T2DM	
Yes	22 (14.7)
No	128 (85.3)
K/C/O dyslipidemia	
Yes	33 (22.0)
No	117 (78.0)
K/C/O HTN	
Yes	38 (25.3)
No	112 (74.7)
Frequency of HTN	
Normal	45 (30.0)
Pre HTN	48 (32.0)
HTN	57 (38.0)
Pattern of HTN	
Normal	45 (30.0)
Pre-HTN	48 (32.0)
Isolated systolic HTN	32 (21.3)
Isolated diastolic HTN	4 (2.7)
Both systolic and diastolic HTN	21 (14.0)
Staging of HTN	
Normal	45 (30.0)
Pre-HTN	48 (32.0)
Stage-1 HTN	52 (34.7)
Stage-2 HTN	5 (3.3)

*K/C/O: Known Case of, T2DM: Type 2 diabetes mellitus, HTN: Hypertension

DISCUSSION

Uncontrolled HTN is one of the most important points of concern for anesthesiologist as HTN and it is one of the most common avoidable causes of postponement of surgery.[13] In this study, the frequency of HTN and pre-HTN was 38.0% and 32.0%, respectively. About 25.3% of the study subjects were diagnosed case of HTN while 12.7% were newly diagnosed HTN. In our study, the frequency of isolated systolic HTN was found to be 21.3% followed by 2.7% and 14.0% frequency of isolated diastolic HTN and both systolic and diastolic HTN, respectively. Increasing age was found to be a significant risk factor for HTN since 66.7% of the study subjects who were ≥60 years had pre-operative HTN as compared to 56.9% and 16.4% who were in the age group of 41–60 years and 20–40 years, respectively. Apart from increasing age, male gender was another significant non-modifiable risk factor for HTN in our study. Smoking, overweight, obesity, dyslipidemia, and T2DM were found to be significant modifiable risk factors for HTN in this study.

Although the studies on pre-operative HTN are rare in Indian settings, few studies from Western countries reported a 10–25% prevalence of pre-operative HTN.[14] A record

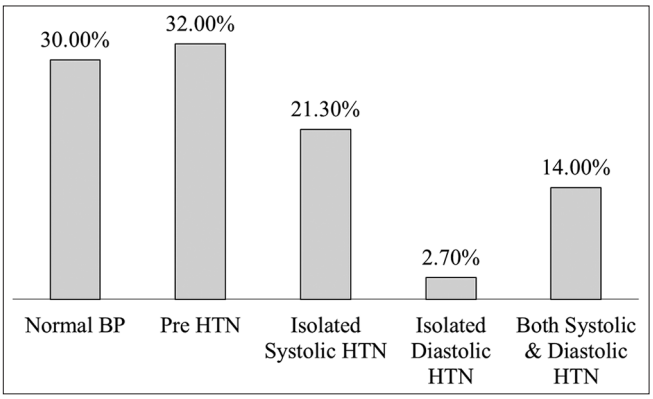

Figure 2: Simple bar diagram showing pattern of pre-operative hypertension among study subjects (*n* = 150)

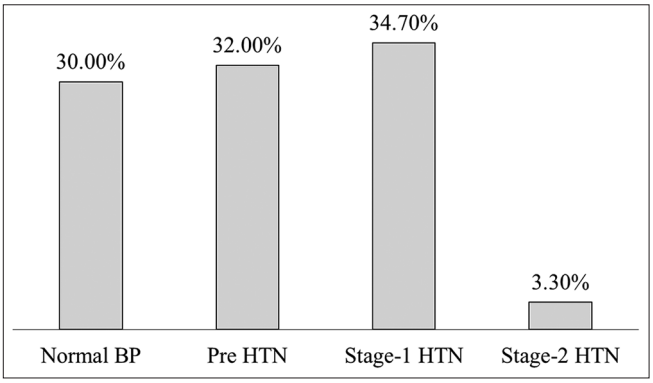

Figure 3: Simple bar diagram showing classification of blood pressure as per Eighth Joint National Committee-8 among study subjects (*n* = 150)

Table 3: Association between clinico-social determinants and hyperglycemia (*n*=158)

C-S factors	BP			Total *n* (%)	χ^2 (df)	*P* value
	Normal (%)	Pre HTN (%)	HTN (%)			
Age group (years)						
20–40	33 (45.2)	28 (38.4)	12 (16.4)	73 (100.0)	30.6 (4)	0.000
41–60	11 (16.9)	17 (26.2)	37 (56.9)	65 (100.0)		
≥61	1 (8.3)	3 (25.0)	8 (66.7)	12 (100.0)		
Sex						
Male	11 (16.7)	21 (31.8)	34 (51.5)	66 (100.0)	12.6 (2)	0.002
Female	34 (40.5)	27 (32.1)	23 (27.4)	84 (100.0)		
Religion						
Hindu	38 (30.9)	37 (30.1)	48 (39.0)	123 (100.0)	1.15 (2)	0.561
Muslim	7 (25.9)	11 (40.7)	9 (33.4)	27 (100.0)		
Educational status						
Illiterate	4 (36.4)	2 (18.2)	5 (45.5)	11 (100.0)	4.02 (6)	0.673
Up to class V	8 (24.2)	10 (30.3)	15 (45.5)	33 (100.0)		
Class VI–X	18 (30.5)	23 (39.0)	18 (30.5)	59 (100.0)		
>Class X	15 (31.9)	13 (27.7)	19 (40.4)	47 (100.0)		
Current smokes						
Yes	12 (18.5)	22 (33.8)	31 (47.7)	65 (100.0)	8.04 (2)	0.018
No	33 (38.8)	26 (30.6)	26 (30.6)	85 (100.0)		
BMI (Kg/m^2)						
Normal (18.5–24.99)	37 (39.8)	29 (31.2)	27 (29.0)	93 (100.0)	14.5 (4)	0.006
Overweight (25.00–29.99)	6 (13.0)	17 (37.0)	23 (50.0)	46 (100.0)		
Obese (≥30.00)	2 (18.2)	2 (18.2)	7 (63.6)	11 (100.0)		
T2DM						
Yes	4 (18.2)	4 (18.2)	14 (63.6)	22 (100.0)	7.19 (2)	0.027
No	41 (32.0)	44 (34.4)	43 (33.6)	57 (100.0)		
Dyslipidemia						
Yes	4 (12.1)	5 (15.2)	24 (72.7)	33 (100.0)	21.7 (2)	0.000
No	41 (35.0)	43 (36.8)	33 (28.2)	117 (100.0)		

HTN: Hypertension, BP: Blood pressure, BMI: Body mass index, T2DM: Type 2 diabetes mellitus

based study from Kathmandu university reported a 10.6% prevalence of pre-operative HTN.[15] About 16.8% prevalence of HTN and 43.8% prevalence of pre-HTN among Durgapur residents were reported by Kumar *et al*.[2] Higher prevalence of pre-HTN among Durgapur residents might have been the cause of the high prevalence of pre-operative HTN in this study as hospitalization and surgery itself is a stress factor[10] and might have unmasked the "white coat" HTN among our study subjects. This is also supported by the fact that 25.3% of the study subjects were already a diagnosed case of HTN, and 12.7% were diagnosed 1st time during our study. A much higher prevalence of 49.9% and 29.3% of systolic and diastolic HTN, respectively, among urban population of West Bengal was reported by Das *et al*.[16] About 11.0% and 26.0% prevalence of undetected HTN was reported among <40 years of age and >40 years of age, respectively, from Western India.[17] The HTN was significantly higher among male study subjects. The significant male preponderance of HTN was also reported by a few other studies.[18,19] In this study, smoking was found to be a significant modifiable risk factor for pre-HTN and HTN which is in agreement with other studies.[2,20-25] About 63.6% of the obese population was hypertensive as compared to 50.0% and 29.0% of overweight and normal BMI study subjects. Increasing BMI as a risk factor for HTN and pre-HTN was also reported by other researchers.[21-23,26] More than 3/5th (63.6%) of the study subjects who had diabetes were hypertensive and about 1/5th (18.2%) were pre-hypertensive. Almost similarly, 64.4% prevalence of HTN among diabetes people was reported by Basavegowda *et al*.[27] However, Dhobi *et al*.[28] and UKPDS[29] group reported a lesser prevalence of about 42.0% and 39.0%, respectively, than our study. A significant association between HTN and ischemic disease with diabetic food syndrome was also reported by Gupta *et al*.[30] The presence of dyslipidemia was found to be a significant risk factor for HTN as 72.7% of the dyslipidemia study subjects were hypertensive as compared to only 28.2% of non-dyslipidemia study subjects. Coexistence of HTN and dyslipidemia is a very common experience

in clinical practice. This may be due to the fact that both HTN and dyslipidemia share a common pathophysiological mechanism like obesity, which promotes dysregulation of adipocytokine release.[31] Dyslipidemia also increases the risk of HTN by adversely affecting the structural and functional properties of arteries by promoting atherosclerosis.[32,33] Many cohort studies have reported a causal relationship between dyslipidemia and future risk of HTN.[34-41]

Limitation of the study includes non-randomized sampling technique, skewed female gender preponderance of study subjects, and short duration of the study. However, despite some potential limitation, this study is first of its kind in Eastern India region which explored the burden of pre-operative HTN.

CONCLUSION

There is a very high prevalence of pre-operative HTN and pre-HTN. Increasing age, male gender was significant non-modifiable risk factors for HTN. Smoking, overweight, obesity, dyslipidemia, and T2DM were significant modifiable risk factors for HTN. Routine screening of HTN should be done in surgical ward to see if there are cases of "white coat" HTN. Newly detected pre-hypertensive and hypertensive patients should be sent to a physician after discharge for evaluation and lifestyle as well as a pharmacological intervention if required.

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