"EVALUATION OF SERUM URIC ACID LEVEL IN PRIMARY HYPERTENSION – A ONE YEAR CROSSSECTIONAL STUDY"

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LIST OF ABBREVIATIONS

ACC	-	American College of Cardiology
AHA	-	American Heart Association
BMI	-	Body mass index
BP	-	Blood Pressure
cm	-	Centimetre
Cumm	-	Cubic millimeter
CV	-	Cardiovascular
DBP	-	Diastolic blood pressure
DM	-	Diabetes mellitus
EDTA	-	Ethylenediaminetetraacetic acid
ESC/ESH	-	European Society of Cardiology/European Society of Hypertension
ET	-	Endothelin
ETA	-	Endothelin receptor A
GBD	-	Global burden of diseases
GFR	-	Glomerular filtration rate
H/O	-	History of
HBPM	-	Home blood pressure measurement
HDL	-	High density lipoprotein
HPRT	-	Hypoxanthine phosphoribosyltransferase
HTN	-	Hypertension
JNC VII	-	Joint National Committee of Prevention, Diagnosis, and Treatment of High Blood Pressure

kg	-	Kilograms
Kg/m^2	-	Kilograms per square meter
LDL	-	Low density lipoprotein
LVH	-	Left ventricular hypertension
m	-	Meters
mg	-	Milligram
mg/dL	-	Milligrams per deciliter
mL	-	Milliliter
mm Hg	-	Millimeters of mercury
n	-	Total number
NO	-	Nitric oxide
p	-	Probability
r	-	Pearson correlation coefficient
R^2	-	Square of the correlation
SBP	-	Systolic blood pressure
SD	-	Standard deviation
SUA	-	Serum uric acid
TSH	-	Thyroid stimulating hormone
UA	-	Uric acid
vs	-	Versus

ABSTRACT

Background and objectives

It is reported that, there is association between serum uric acid levels (SUA) and hypertension (HTN). This study was aimed to evaluate the relationship between SUA levels and primary HTN.

Methods

This one year hospital based cross sectional study was conducted from January 2018 to December 2018 in the Department of General Medicine, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi. A total of 100 patients with primary hypertension were enrolled. These patients were evaluated for SUA levels and severity of HTN based on 2017 ACC/AHA guidelines.

Results

Thepresentstudy showedstrong correlationbetween SUA levelwith systolic blood pressure (SBP) and diastolic blood pressure (DBP) inpatientswithprimary HTN.Elevated SUA levels weresignificantlyassociated with body mass index (BMI) andDyslipidemia. Themean SUA levelswere 6.36±2.33mg/dLand raised SUA wasseenin38%.The meanSBP (163.89±9.99 vs 151.4±10.78 mmHg p<0.001)andmeanDBP (95.89±3.83 vs 91.96±5.15 mmHg p<0.001)weresignificantlyhighinhyperuricemic patients. The mean SUA levelsinstage2 HTN (6.38±2.37mg/dL)were highcomparedtostage1 HTN (5.77±0.79mg/dl).Male tofemaleratio was2.12:1.SignificantcorrelationwasseenbetweenBMIand SUA levels (r=0.559;R^2=0.313;p<0.001). Significant correlationwasseenbetween SUA level with

totalcholesterol ($r=0.548;R^2=0.299;p<0.001$), low density lipoprotein ($r=0.467;R^2=0.299;p<0.001$), high density lipoprotein ($r=0.467;R^2=0.217;p<0.001$) and triglyceride ($r=0.446;R^2=0.199;p=0.013$) levels.

Conclusion and interpretation

Patients with primary HTN arelikelytopresentwithraised SUA levelsandthereisstrongassociationbetweenelevated SUA levelswithSBP andDBP.Furthermoreelevated SUA levelsaresignificantlyassociatedwithBMIanddyslipidemia. Howeverthehyperuricemia inpatientswithprimaryHTNisindependentofsexandage.

Keywords

Hyperuricemia; Primary hypertension; Serum uric acid;

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INTRODUCTION

In 1776 it was discovered that uric acid is the end product of purine and serves no biochemical function. Subsequently it was isolated from urinary tract stone by Swedish chemist by name Scheele. Uric acid was detected in a tophus by British chemist Wallaston in 1797 which was taken out from his ear. Later after 50 years Alfred Baring Garrod proved abnormal high uric acid in patients with gout.[1]

Association of hyperuricemia and hypertension was observed when a family visited hammer smith hospital in 1957, with a unique pedigree. The six out of seven siblings had raised serum uric acid levels and all siblings were hypertensives. This created a question of whether a hyperuricemia was a common in hypertension.[1]

Hypertension is the most common risk factor for global mortality and morbidity. According to global burden of diseases study[2] (GBD) hypertension, tobacco use and poor dietary intake are the important risk factors for morbidity and mortality.[2,3]

In India, several studies have reported that there is increased burden of hypertension.[3-5] Hypertension results from the interaction between genetic factors and environmental factors.[6]

Serum uric acid plays a role in development of hypertension. Increased serum uric acid results from either increased synthesis of uric acid, or reduced excretion, or both. Raised serum uric acid is one of the risk factor for development of cardiovascular disease. And it is related with hypertension.[7]

Uric acid is considered to have a role in raised blood pressure by multiple mechanisms such as by acting on renin angiotensin system and affecting vascular endothelium and smooth muscles, and also by generating free radical.[7]

Many authorities do not consider an elevated UA to be a true cardiovascular risk factor, because patients with hyperuricemia often have other well-established risk factors for cardiovascular disease, such as hypertension, renal disease, obesity, dyslipidemia, and insulin resistance[8] and data showing association between hypertension in hyperuricemia is lacking.[7-9] Also there is no control on confounding factors by which there is effect on serum UA for example history of taking drugs causing raised uric acid, obesity, kidney function and some of them were performed on less number of patients.[9]

Furthermore, there was no such study done in our hospital setting before. Considering these facts the present study was undertaken to determine whether raised serum uric acid levels were risk factor for development of hypertension and also in order to aid the diagnosis of primary hypertension as well as the severity of hypertension.

OBJECTIVES

The objective of this study was to evaluate the serum uric acid levels in primary hypertension.

REVIEW OF LITERATURE

HYPERTENSION

Hypertension is third leading killer disease in the world. The prevalence of hypertension increases with age. Framingham heart study has reported that those who are having normal blood pressure at 55-65 years and survived to the age of 80 to 85 years there is life time risk of developing hypertension nearly 90%.[10]

Most of the studies have shown that hypertension is an independent risk factor for cerebrovascular and cardiovascular diseases. Observation involving more than 1 million people have shown that death from stroke and cardiovascular diseases increases with increase in blood pressure.[11]

For every 20 mm Hg raise in systolic and 10 mm Hg raise in diastolic blood pressure was associated with two fold increase in mortality due to cerebrovascular and cardiovascular disease.[5] Hence control of blood pressure reduces overall mortality and morbidity due to stroke and cardiovascular disease.

Definition

The best operational definition is the level at which the benefit of action exceed the risks and costs of inaction.[12]

Classification of hypertension

Primary hypertension (essential hypertension) is common type of hypertension, seen in 95% of hypertensives.[13-16] Primary hypertension is familial and it is due to the interaction between genetic and environmental factors.

Second type of hypertension is secondary hypertension, it is called secondary because the underlying pathological cause which is causing hypertension. it constitutes 5%.[13]

There is increased risk of cardiovascular and cerebrovascular disease in case of hypertension.[13]

HISTORICAL REVIEW OF HYPERTENSION

Reverend Stephen Hales is considered as the Father of sphygmomanometery, in (1773).[17]

Poiseuille introduced the mercury manometer. A noninvasive method of obtaining blood pressure that led to our current technique was introduced by Scipione Riva Rocci in 1896.[17]

In 1905 Nicolai Korotkoff first observed the sounds produced by a constriction of the artery. He observed, there were characteristic sounds these sounds known as Korotkoff sounds and corresponding to the systolic and diastolic blood pressure.[18]

There are many new technologies have developed to measure blood pressure, continuous BP monitoring, strain gauges, photocells.[17]

SIGNIFICANCE OF HYPERTENSION

Hypertension is most common noncommunicable disease. Now a days hypertension is becoming one of the common public health issue in both developed and developing countries. This increasing trend is because of obesity, changing life

style, industrialization. And it is an important public health problem because of the associated morbidity and mortality.[19]

Many epidemiological studies have shown that in India prevalence of hypertension is more in urban population (25%) than in rural population (10%). And it is major health issue in India responsible for 50% deaths associated with stroke and 40% cardiovascular deaths. Most common cause of blindness, renal failure and congestive heart failure is hypertension.[19,20]

Early diagnosis by routine health checkup, patient education and proper treatment has reduced the morbidity rates in hypertension caused by end organ damage.[19]

CLASSIFICATION OF BLOOD PRESSURE

The risk of morbidity and mortality increases with severity of hypertension hence a classification system is required for making decision on treatment of hypertension .[21,22]

‘’As per the Seventh Report of the Joint National Committee of Prevention, Diagnosis, and Treatment of High Blood Pressure (JNC VII), the classification of BP (expressed in mm Hg) for adults aged 18 years or older is as follows.[23]

Classification	Systolic BP in mm Hg	Diastolic BP in mm Hg
Normal	<120	<80
Pre hypertension	120-139	80-89
Stage 1	140-159	90-99
Stage 2	160	100

This classification is based on the average of two or more readings taken at each of two or more visits after initial screening.

Prehypertension, is a new entity which has been added, and stage 2 and 3 has been combined in the JNC VII report, prehypertension has more risk of progression to hypertension. Lifestyle modification is advised for patients with prehypertensio.[23]

Hypertensive urgency is defined as blood pressure above 180/110 mm Hg and mild end organ effects, as headache and mild breathlessness. Hypertensive emergency is defined as blood pressure of 220/140 mm Hg or greater with life-threatening end-organ damage.[24]

JNC 8 classification[25] was published two decades after JNC 8.[25] Which added the information regarding treatment as per age and associated co morbidities.

The American College of Cardiology (ACC) and American Heart Association (AHA) published a clinical guideline for the prevention, detection, and treatment of hypertension (BP) in adults in 2017.[26]

Classification of BP according to 2017 ACC and AHA clinical practice guidelines[26]

Category	**Blood pressure (mm Hg)**
Normal	<120/80
Elevated	120-129/<80
Stage 1	130-139/80-89
Stage 2	>140/90

According to guidelines average of two readings should be taken on two separate occasions. Proper method and adequate cuff size should be used for measuring blood pressure. Measurement of BP by proper methods.

1. Out of office blood pressure measurement should be done home blood pressure measurement (HBPM) for confirming and starting treatment for hypertension.
2. In patients with office blood pressure more than 130/80 should be screened for white coat blood pressure.
3. Patients having white coat blood pressure should be frequently monitored to diagnose progression of hypertension.
4. In hypertensive patients who are on treatment screening should be done to see the end organ damage.[26]

According to 2018 European Society of Cardiology/European Society of Hypertension (ESC/ESH) Guidelines,[27] definition of hypertension is same (office BP 140/90 mm Hg)

The 2017 ACC/AHA clinical practice guideline for blood pressure represents recommendations for diagnosis, initiation of treatment and targets for hypertension.[26]

Overall, the use of 130/80 mm Hg as a diagnostic threshold and treatment goal of BP contributes to more sustained target organ protection and cardiovascular (CV) disease prevention. This is particularly applicable to Asia, where the achievement of normal BP levels for prevention of cardio and cerebrovascular accident is a priority in the treatment of hypertension.[29]

Epidemiology

Worldwide

Hypertension is one of the global public health issue and is a major cause of morbidity and mortality worldwide. The prevalence of hypertension is increasing in many Asian countries, with a many countries with blood pressure above the global average. The average of systolic blood pressure is decreasing worldwide from the year of 1980s with a rate of about 1 mm Hg SBP per decade, and it is increasing in developing countries, mainly in the Asian population.[29]

The result of Global Burden of Disease,[29,30] The number of people with systolic BP of 140 mm Hg or more has increased from 442 million to 874 milion. Asia is one of the most populous region in the world. Its rapid population growth has presented burden of chronic disease and health service demand to all countries. Particularly in India and China.[29,31]

Prevalence of Hypertension is different between different studies, ranging from 13.6% to 47.9%, and higher in individuals of urban areas compared to rural areas. According to latest studies Prevalence of hypertension[32] was 17.9% in Bangladesh, 31.4% in India 23.9% in Bhutan, 31.5% in Maldives, 25% in Pakistan, 47% in Mongolia, 33.8% in Nepal and 20.9% in Sri Lanka 20.9%.[29]

Indian scenario

Hypertension is an important risk factor for cardiovascular, renal and cerebrovascular disease burden in India. Most of the Studies in India reported high prevalence of hypertension. Hypertension in large population based study reported

hypertension in 13.8% men vs. 8.8% women aged 15–49 and 15–54 respectively, by national health survey.[3,33]

Association between hypertension and its risk factors

Many factors contributes to the pathogenesis of hypertension. Which include sedentary lifestyles, unhealthy diet, obesity, smoking, family history of hypertension.[3,34]

Primary and secondary hypertension

Primary hypertension also called as idiopathic or essential hypertension in which cause is not known, and it constitutes about 90 to 95%. If hypertension is caused by an underlying cause it is called as secondary hypertension (5- 10%).[35]

Since the aim of this study is mainly to measure the blood uric acid levels in primary hypertension, this review is limited to primary hypertension only.

Primary (Essential hypertension or idiopathic hypertension)

Primary hypertension is also known as essential hypertension and it constitutes 95% of hypertensives. Primary hypertension is characterized by increase in blood pressure (BP) due to an unknown etiology. In majority of individuals etiology cannot be determined (90%).and in small fraction of cases hypertension is due underlying specific causes. Primary hypertension is a multifactorial disease arising from the interaction of genetic, behavioral and environmental factors. It affects nearly 95% of hypertensive patients.[35]

Risk factors

A number environmental factors, such as obesity, socioeconomic status, stress, smoking, high salt diet and vitamin D deficiency, are known to play role in the development of primary hypertension. Family history of hypertension increases the risk for development of hypertension in an individual.[36]

Primary hypertension is more common in black people than white, and is more severe with higher mortality.[13,37,38] Increase in BMI commonly associated with hypertension by fivefold as compared with normal weight individual, upto 60% of hypertension cases are attributed to obesity. More than 80% of cases are seen in individual with a Body mass index more than 25.[13,39]

Increased rennin activity stimulates release of aldosterone which causes excess retention of sodium and water leading to hypertension. Hypertension can also be caused by Insulin resistance and or hyperinsulinemia, which are components of metabolic syndrome.[36]

Pathogenesis

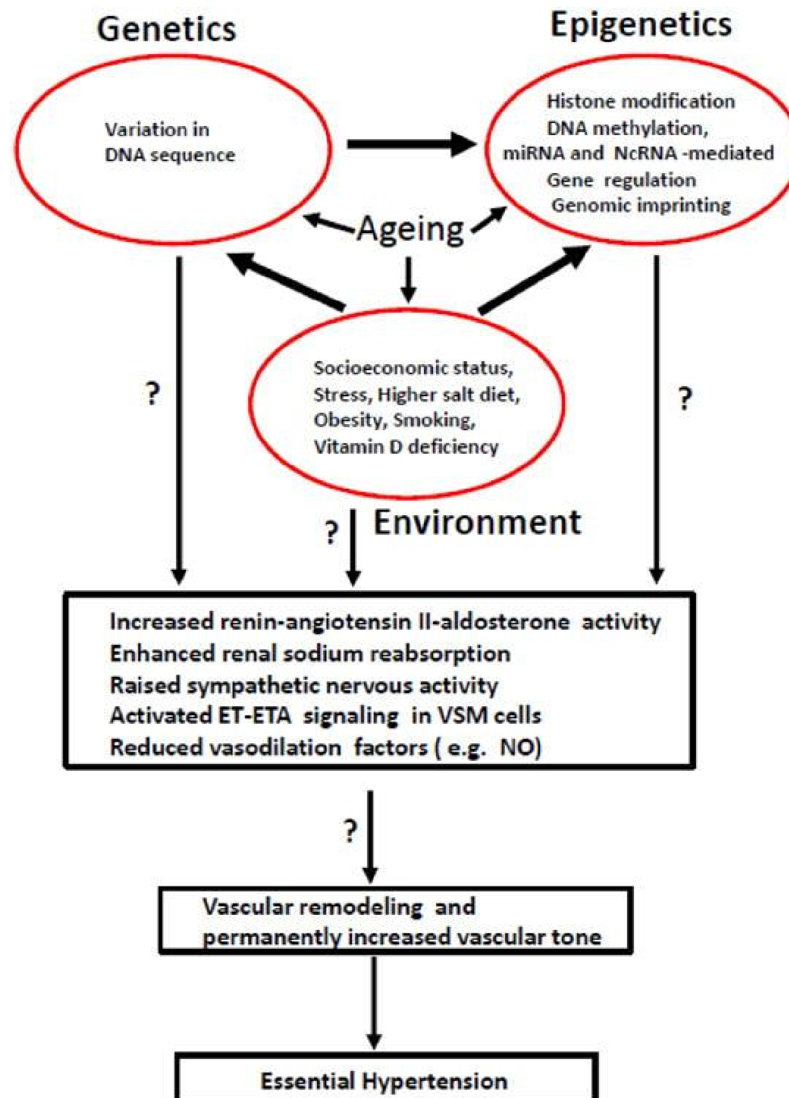


Figure 1. Ddifferent causal factors with ageing trigger vessel remodeling and permanently increased vascular tone leading to EH through unknown BP signaling molecules.[36] (ET: endothelin, ETA: ET receptor A, NO: nitric oxide)

Serum Uric Acid

Uric acid (UA) is the end product of purine metabolism; in animals its conversion to allontoin is carried out by urate oxidase.[40] However, during evolution

there was mutation in uricase gene .and uric acid level in humans are higher in animals.[41,42]

So Many Metabolic diseases are associated with defect in uric acid metabolism. Studies have shown that there is a role of uric acid in causing raised blood pressure and also it is associated with hypertension. By using drugs which decreases the uric acid level, blood pressure can be lowered. Uric acid by acting on RAS system causes excess retention of sodium and water.[42]

Evidence shows an intimate relationship between serum UA level and hypertension.[43] Elevated UA by causing vascular dysfunction contributes in development of hypertension.[44]

Hypertension and uric acid

The association of uric acid and hypertension is known since many years. Fredric proposed that uric acid plays a role development of primary hypertension.[45,46] Haig[47] proposed that consumption of low purine diet helps to prevent hypertension. In 1909 Henri Huchard[48] a French academician noted renal arteriolosclerosis was seen in three groups: Those with lead poisoning, those who consume diet high in red meat, and those with gout. All these were associated with raised serum uric acid level.[45]

The concept of uric acid in hypertension is known since many years but because of scarcity of information it received less attention.[1,49-52] About 25 to 40% of untreated hypertensives have raised serum uric acid level.[52]

Metabolism

Oxidation of purine leads to formation of uric acid. The source of purine may be exogenous or endogenous in origin. The purine nucleotides are produced either directly from purine bases or synthesized newly. These nucleiotides are degraded to their monophosphates. Lastly inosine monophoshate to hypoxanthine which is converted to xanthine then to uric acid.[53]

Causes of hyperuricemia

Raised serum uric acid can be due increased production or decreased excretion or both. Normal uric acid is between 3 to 7 mg/dl and it varies depending on the method of estimation.[53,54]

The causes for excess uric acid production includes diet rich in purine, deficiency of hypoxanthine phosphoribosyltransferase (HPRT) enzyme, malignancy, alcohol and obesity, psoriasis, pagets disease.[53,54]

Causes for decrease excretion are renal failure, acidosis, diabetes incipedius, hypothyroidism, polycystic kidney disease, various drugs like diuretics, cyclosporine, levodopa and alcohol.[53,54]

Combined mechanism includes alcohol, shock, glucose 6 phosphatase deficiency.[53,54]

There are various studies which shows the relationship between uric acid and hypertension and raised serum uric acid is a risk factor for cardiovascular disease.[9,55,56]

In a study involving 30 newly diagnosed primary hypertensives raised uric acid was observed in 89%.[57] Treatment with allopurinol normalized the blood pressure in 60% of individuals.[58]

A study showed that uric acid infusion in healthy individuals did not alter endothelial function instead it improved its function in diabetics and smokers.[59]

Uric acid function as antioxidant extracellularly and when uric acid present inside the cell it acts as pro oxidant.[60]

Meserli et al.[61] in 1980 studied glomular filtration rate and renal blood flow and there was decreased glomerular filtration rate (GFR) and renal blood flow in individuals with raised serum uric acid level and concluded that raised uric acid is a sensitive marker of impaired renal function.

Studies on primary hypertension and serum uric acid

The relation between hypertension and serum uric acid is known since 1950s but because of lack of explanation, it received less attention. Around 20-40% patients with hypertension have their serum uric acid more than normal.[62]

In 1990 Kahn et al.[63] reported that in hypertension raised serum uric acid is an independent risk factor. More than 60% have serum uric acid more than 5.5 mg/dl.[62] It is also reported that there was direct relationship of systolic blood pressure and serum uric acid.[8,62]

The recent evaluation of a subset from the Framingham heart study showed that, raised serum uric acid predicts the development of hypertension.[63]

Raised uric acid level is seen in 30-60% of patients with primary hypertension not on treatment.[10]

Ofori SN and Odia OJ.[64] reported a case control study in 2014 by including 130 cases (newly diagnosed primary hypertension) and 65 patients as control (healthy patients). It was done to see the relationship between uric acid level and end organ damage. Mean of serum uric acid was more in hypertensives (379±97.7) and prevalence was 46%. End organ damage like microalbuminuria and left ventricular hypertention (LVH) was more common in hypertensive patients.

In 2015 Anand NN. et al.[8] reported a study which was done to see the relationship between newly diagnosed primary hypertension and raised serum uric acid with regard to risk factors like obesity and smoking .total of 50 patients with hypertension and 50 without hypertension were included in the study . The result showed the raised serum uric acid levels in hepertensives as compared to normotensives. Hyperuricemia was more in males compared females. No difference was found with obesity and smoking.

Neki NS and Tamilmani[65] conducted a case control study involving 400 individuals out of which 200 were cases. As per JNC 7, cases were categorized into stage 1 and stage 2 and mean uric acid levels were calculated which was high in cases (5.8 mg%) than control (4.8 mg%). Uric acid level was high in stage 2 compared to stage 1. It concluded that as the severity and duration of hypertension increases the serum uric acid level increases.

In 2015, Lee JJ et al.[9] reported that after adjustment for age, sex, BMI and GFR the serum uric acid was associated with both systolic and diastolic blood pressure.

METHODOLOGY

This study was undertaken in the KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi from January 2018 to December 2018.

Study design

The study was a one year hospital based cross sectional study.

Study period and duration

The duration of study was one year from January 2018 to December 2018.

Setting

The present study was carried out in the KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi a tertiary care teaching hospital attached to KLE University's Jawaharlal Nehru Medical College, Belagavi.

Source of Data

Patients with primary hypertension presenting to the KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi were enrolled.

Sample size

A total of 100 patients presenting with primary hypertension fulfilling the selection criteria were selected for the study.

Sampling procedure

Based on the following formula, sample size was calculated as mentioned below.

$n = 4 X p X q / d^2$

Where, p = Prevalence of the disease which was considered as 50% due to scarcity of data on primary/essential HTN in the study area

q = 100 – p =100-50 = 50

d = Absolute error taken as 10%

Therefore, $n = 4 X 50 X 50 / 10^2$

$n = 100$

Hence a sample size of 100 was considered for the study. A total of 100 consecutive patients fulfilling the selection criteria were enrolled.

Selection criteria

Inclusion Criteria

- Patients with newly detected primary hypertension according to the 2017 American College of Cardiology/American Heart Association (ACC/AHA) guidelines.
- Adult Patients aged >18 years.

Exclusion criteria:

- Patients with renal failure
- Patients on treatment with drugs which alters the serum uric acid levels such as thiazides, loop diuretics, pyrazinamide, allopurinol, ethambutol.

- Patients with gout
- Patients with malignancy.
- Patients with secondary hypertension and pregnancy induced hypertension.

Ethical clearance

Prior to the commencement, the study was approved by the Institutional Ethics Committee of Jawaharlal Nehru Medical College, Belgaum.

Informed consent

Patients admitted in KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum were screened for eligibility based on selection criteria. Those who fulfilled the selection criteria were explained about the nature of the study and a written informed consent was taken (Annexure–I) prior to the enrollment.

Data collection

Patients were interviewed and demographic information like age, gender and occupation were noted. Detailed history of other associated medical conditions along with treatment history and personal history were recorded. A thorough general physical examination was conducted to evaluate systolic and diastolic blood pressure and height and weight were measured and body mass index (BMI) was calculated as the weight in kilograms (kg) divided by the square of the height in meters (m). All findings were recorded on a pretested and predesigned proforma (Annexure-II).

Hypertension

Systolic and diastolic BP were measured in all of the subjects. The diagnosis of hypertension done according to 2017 ACC and AHA clinical practice guidelines[26] that is a systolic BP of 130 mm Hg or higher and a diastolic BP of 80 mm Hg or higher. Blood pressure was measured in the sitting position after rest for five minutes.

Body mass index

Body mass index calculation was done by following formula.

$$\text{Body Mass Index} = \frac{\text{Weight (Kg)}}{\text{Height}^2\text{ (m)}}$$

Body mass index was classified according to Overweight and obesity by BMI in adult Asians as below.[66]

Classification	BMI (Kg/m^2)	Risk of co-morbidities
Underweight	< 18.5	Low (But increased risk of other clinical problems
Normal range	18.5 to 22.9	Average
Overweight	23	
At risk	23.0 to 24.9	Increased
Obese I	25.0 to 29.9	Moderate
Obese II	30.0	Severe

Investigations

Under aseptic conditions, 2 mL of venous blood was collected in Ethylenediaminetetraacetic acid (EDTA) vials for investigations. The patients were investigated for serum uric acid, haemoglobin, total count, platelet count, serum urea, thyroid stimulating hormone, random blood sugar, total cholesterol, low density lipoprotein, high density lipoprotein and triglyceride levels.

Study variables

Staging of Hypertension

Systolic and diastolic BP were measured in all of the patients. The staging of hypertension was done according to 2017 ACC and AHA clinical practice guidelines.[26]

Serum uric acid levels

Serum uric acid levels were measured in the early morning venous blood sample. Measurement of serum uric acid levels was done by uricase – POD Enzymatic Colorimetric method using the SPINREACT kit.[67] The normal reference range for uric acid was considered as below.

Normal uric acid levels[67]

- Males – 3.5 to 7.2 mg/dL
- Females – 2.5 to 6.5 mg/dL

Lipid profile

Lipid profile was determined by early morning venous blood sample. Based on NCEP (National Cholesterol Education Program) guidelines[68] normal values of lipid parameters were;

- Low density lipoprotein < 100 mg/dL.
- High density lipoprotein;
    - Female > 50 mg/dL.
    - Males > 40 mg/dL.
- Total Cholesterol < 200 mg/dL.
- Triglycerides < 150 mg/dL.

Statistical analysis

The data obtained was coded and tabulated on Microsoft Excel spreadsheet. The data was expressed as rates, ratios and percentages. Chi-square test was used to see the association between categorical data. Continuous data was expressed as mean±standard deviation (SD) and By using independent sample 't' test, comparison was done. To determine correlation between serum uric acid levels with age, SBP, DBP, total cholesterol, LDL, HDL and triglycerides Pearson's correlation was used. At 95% confidence interval 'p' value less than or equal to 0.050 was taken as statistically significant.

RESULTS

The present one year hospital based cross sectional study was undertaken from January 2018 to December 2018 in KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi. A total of 100 patients with primary hypertension were enrolled.

The obtained data was analysed and the results were tabulated and interpreted as given below.

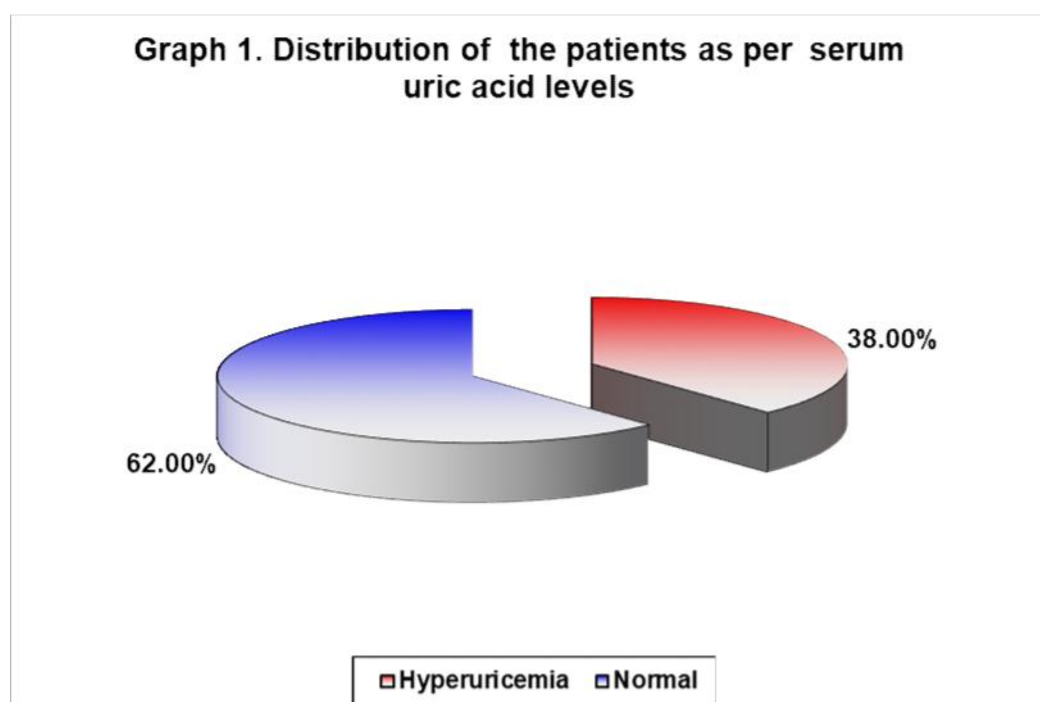
Table 1. Clinical profile of the study population

Variables	Distribution (n=100)		Median	Range (n=100)	
	Mean	SD		Min	Max
Age (Years)	57.22	11.46	58.00	31.00	80.00
Height (cm)	159.62	4.98	159.00	148.00	172.00
Weight (Kg)	61.69	5.90	61.00	51.00	78.00
Body mass index (Kg/m^2)	24.20	1.81	24.25	18.96	30.09
Pulse rate (/Minute)	79.48	7.66	80.00	62.00	90.00
Respiratory rate (/Minute)	19.70	2.33	20.00	16.00	26.00
Systolic blood pressure (mm Hg)	156.16	12.09	156.00	130.00	180.00
Diastolic blood pressure (mm Hg)	93.46	5.05	94.00	80.00	100.00
Serum uric acid (mg/dL)	6.36	2.33	6.15	2.50	13.50
Haemoglobin (gm%)	11.70	2.18	11.65	6.20	17.90
Total count (/Cumm)	8408.70	3973.00	8300.00	3000.00	24000.00
Platelet count (/Cumm)	230.47	89.50	218.50	95.00	531.00
Serum urea (mg/dL)	27.95	9.40	25.00	14.00	50.00
Serum Creatinine (mg/dL)	0.86	0.23	0.90	0.15	1.20
Random blood sugar (mg/dL)	139.61	18.59	139.00	100.00	186.00
TSH (mcIU/ml)	2.11	0.71	2.05	0.80	3.80
Total Cholesterol (mg/dL)	206.15	46.11	210.00	88.00	280.00
Low density lipoprotein (mg/dL)	107.72	22.12	106.00	54.00	150.00
High density lipoprotein (mg/dL)	35.94	14.16	35.50	10.00	64.00
Triglycerides (mg/dL)	159.52	41.71	157.00	72.00	234.00

In the present study the SUA ranged between 2.50 to 13.50 mg/dL. The mean SUA levels were noted as 6.36±2.33 mg/dL and median levels were noted as 6.15 mg/dL respectively. Overall, the SBP levels ranged between 130 to 180 mm Hg and DBP levels ranged between 80 to 100 mm Hg. The mean and median SBP levels were noted as 156.16±12.09 and 156 mm Hg. The mean and median DBP levels were noted as 93.46±5.05 and 94 mm Hg respectively.

Table 2. Distribution of the patients according to serum uric acid levels

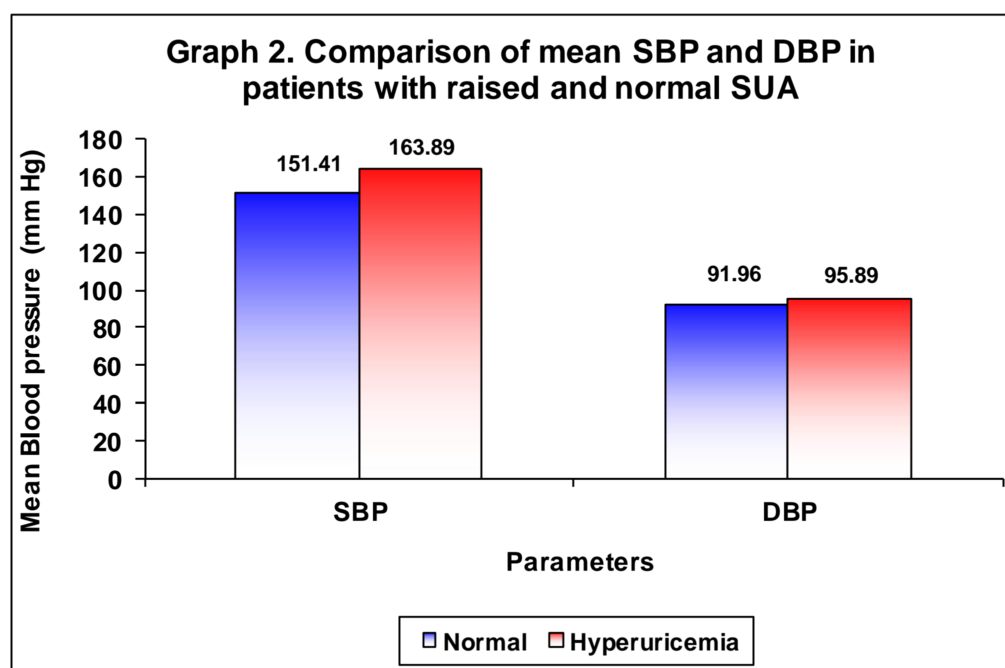
Serum uric acid levels	Distribution (n=100)	
	Number	Percentage
Normal	62	62.00
Hyperuricemia	38	38.00
Total	**100**	**100.00**



In the present study raised SUA levels that is hyperuricemia was seen in 38% of the patients.

Table 3. Comparison between mean SBP and DBP in patients with raised and normal SUA

Parameter	Serum Uric acid levels				p value
	Hyperuricemia (n=38)		Normal (n=62)		
	Mean	SD	Mean	SD	
SBP (mm Hg)	163.89	9.99	151.41	10.78	**<0.001**
DBP (mm Hg)	95.89	3.83	91.96	5.15	**<0.001**

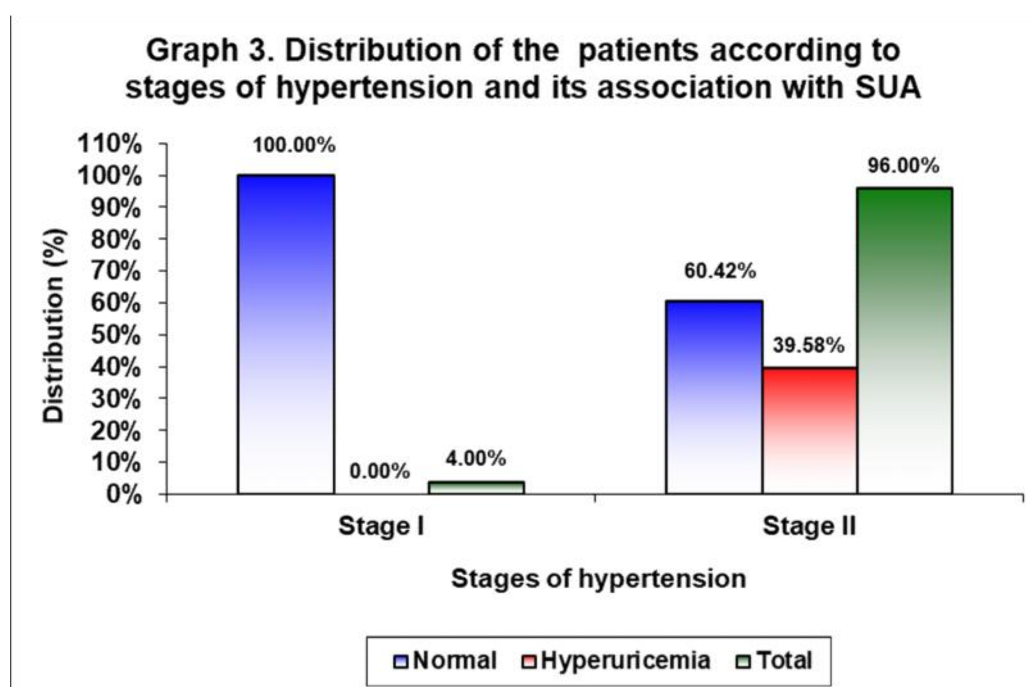


In this study the mean SBP (163.89±9.99 vs 151.41±10.78 mm Hg; p<0.001) and DBP (95.89±3.83 vs. 91.96±5.15 mm Hg; p<0.001) were significantly high in hyperuricemic patients compared to those patients who has normal serum uric acid levels.

Table 4. Distribution of the patients according to stages of hypertension and its association with SUA

Stages of hypertension	Serum Uric acid levels				Total (n=100)	
	Hyperuricemia		Normal			
	No.	%	No.	%	No.	%
Stage I	0	0.00	4	100.00	4	4.00
Stage II	38	39.58	58	60.42	96	96.00
Total	**38**	**38.00**	**62**	**62.00**	**100**	**100.00**

p = 0.142



In this study 39.58% all the patients with stage II HTN had hyperuricemia while none of the patient (0%) with stage I HTN had hyperuricemia. However, this difference was statistically not significant (p=0.142).

Table 5. Comparison of mean SUA in patients with stage I and stage II HTN

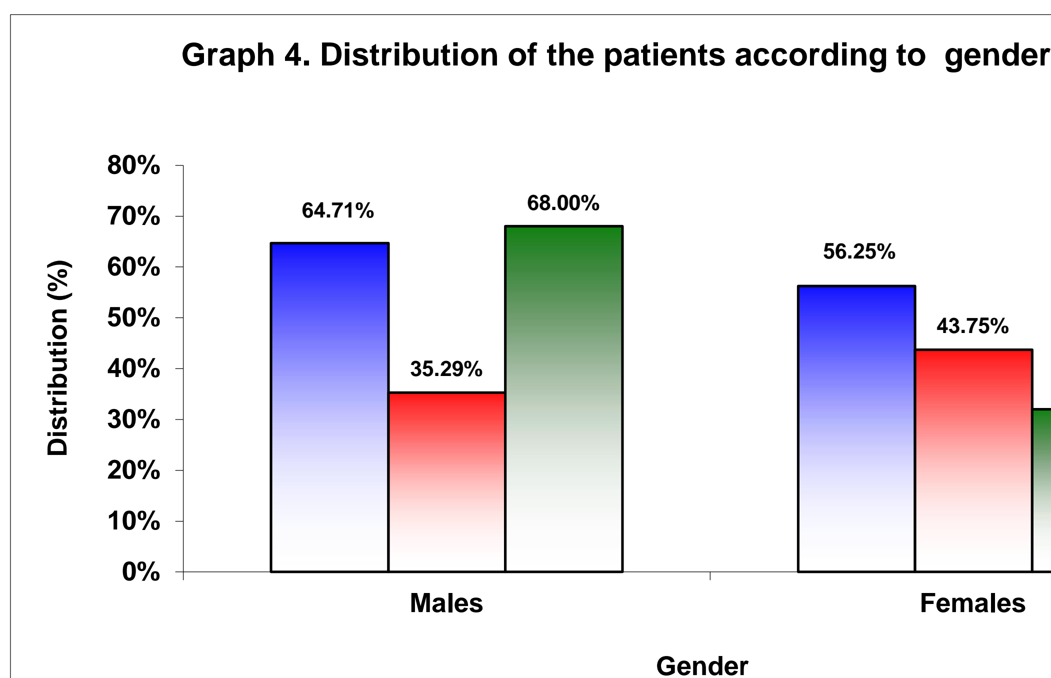
Parameter	Stages of HTN				p value
	Stage I (n=4)		Stage II (n=96)		
	Mean	SD	Mean	SD	
Serum Uric acid levels	5.77	0.79	6.38	2.37	0.238

In this study the mean serum uric acid levels were high in patients with stage II primary HTN (6.38±2.37 mg/dL) compared to those who has stage I primary HTN (5.77±0.79 mg/dL). However the difference was statistically not significant (p=0.238)

Table 6. Distribution of the patients according to the gender and its association with SUA

Gender	Serum Uric acid levels				Total (n=100)	
	Hyperuricemia		Normal			
	No.	%	No.	%	No.	%
Males	24	35.29	44	64.71	68	68.00
Females	14	43.75	18	56.25	32	32.00
Total	**38**	**38.00**	**62**	**62.00**	**100**	**100.00**

p = 0.509



In this study majority of patients were males (68%) and 32% of the patients were females. The male to female ratio was 2.12:1. The frequency of hyperuricemia was slightly high among females (43.75%) compared to males (35.29%). But, the difference observed was statistically not significant (p=0.509).

Table 7. Comparison of mean SUA in males and females

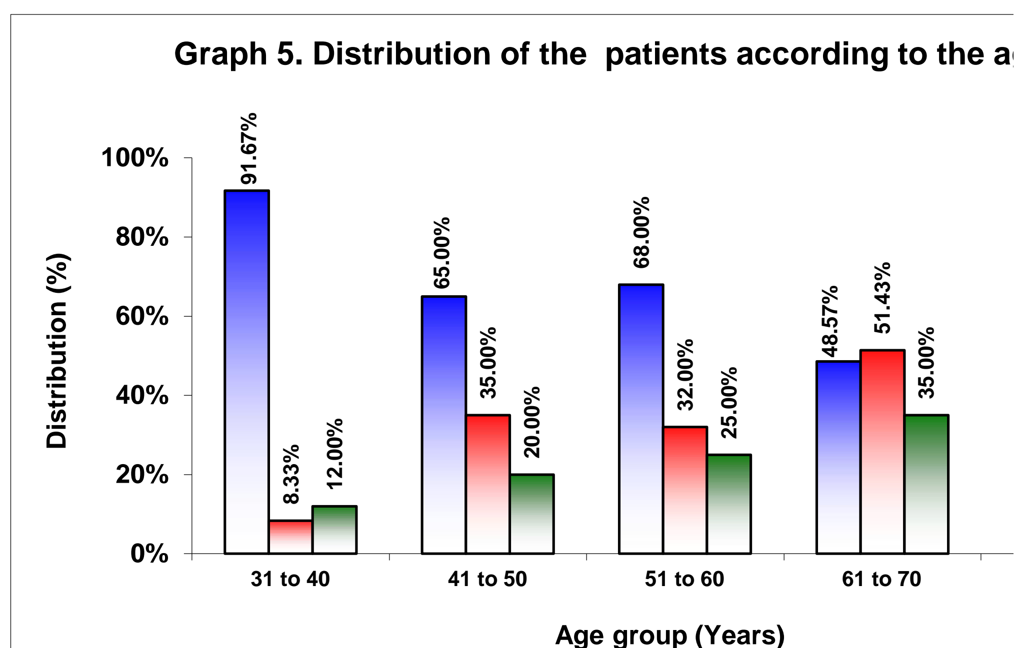
Parameter	Gender				p value
	Males (n=68)		Females (n=32)		
	Mean	SD	Mean	SD	
Serum Uric acid levels	6.43	2.24	6.21	2.55	0.670

In this study the mean serum uric acid levels were slightly high among male patients (6.43±2.24 mg/dL) compared to female patients (6.21±2.55 mg/dL). However the difference was statistically not significant (p=0.670).

Table 8. Distribution of patients according to age and its association with SUA

Age group (Years)	Serum Uric acid levels				Total (n=100)	
	Hyperuricemia		Normal			
	No.	%	No.	%	No.	%
31 to 40	1	8.33	11	91.67	12	12.00
41 to 50	7	35.00	13	65.00	20	20.00
51 to 60	8	32.00	17	68.00	25	25.00
61 to 70	18	51.43	17	48.57	35	35.00
71 to 80	4	50.00	4	50.00	8	8.00
Total	**38**	**38.00**	**62**	**62.00**	**100**	**100.00**

p = 0.088

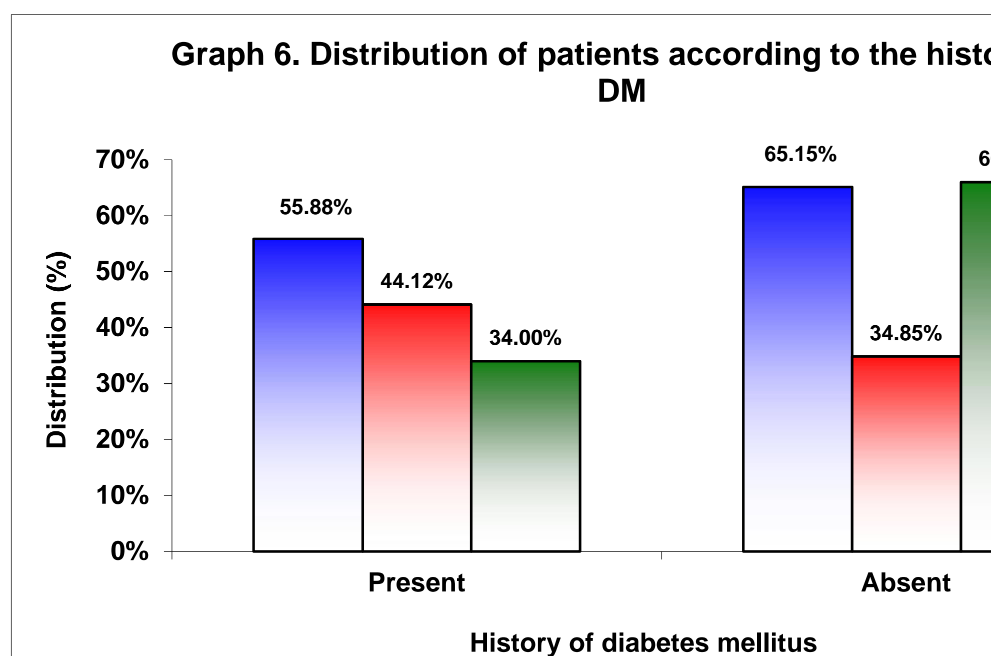


In our study the age of the patients ranged between 31 to 80 years. The mean age was 57.22±11.46 years and median age was 58 years. Most of the patients were aged between 61 to 70 years. However no association was found between hyperuricemia and age (p=0.088)

Table 9. Distribution of the patients according to the H/O of DM and its association with SUA

History of diabetes mellitus	Serum Uric acid levels				Total (n=100)	
	Hyperuricemia		Normal			
	No.	%	No.	%	No.	%
Present	15	44.12	19	55.88	34	34.00
Absent	23	34.85	43	65.15	66	66.00
Total	**38**	**38.00**	**62**	**62.00**	**100**	**100.00**

p = 0.391

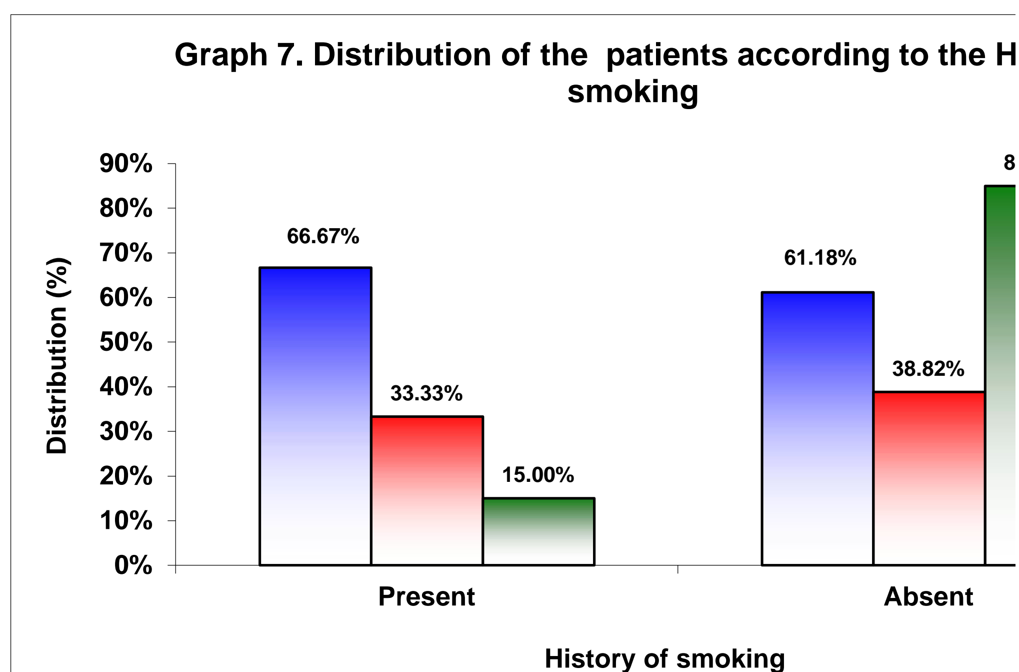


In the present study history of DM was noted in 34% of the patients. Among them, 44.12% of the patients had hyperuricemia. However no association was found between hyperuricemia and history of DM (p=0.391).

Table 10. Distribution of the patients according to the H/O smoking and its association with SUA

History of smoking	Serum Uric acid levels				Total (n=100)	
	Hyperuricemia		Normal			
	No.	%	No.	%	No.	%
Present	5	33.33	10	66.67	15	15.00
Absent	33	38.82	52	61.18	85	85.00
Total	**38**	**38.00**	**62**	**62.00**	**100**	**100.00**

p = 0.779

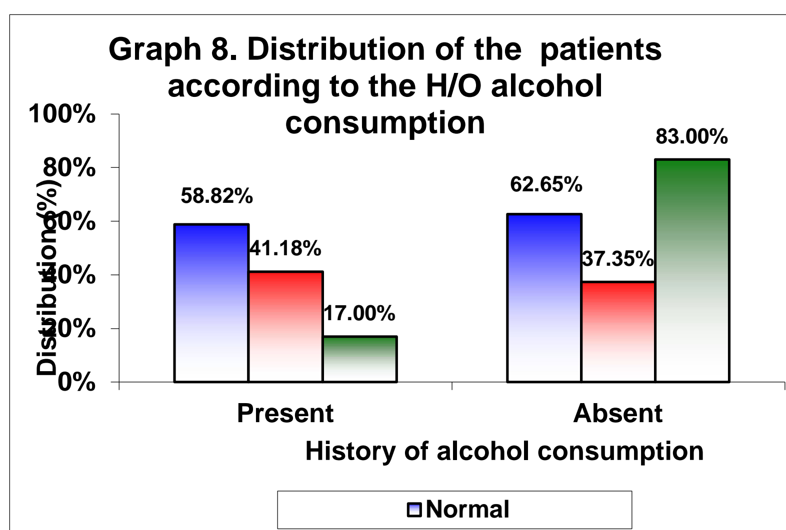


In this study history of smoking was reported by 15% of the patients. Of which, 33.33% of the patients had hyperuricemia. However no association was found between hyperuricemia and history of smoking (p=0.779).

Table 11. Distribution of the patients according H/O alcohol consumption and its association with SUA

History of alcohol consumption	Serum Uric acid levels				Total (n=100)	
	Hyperuricemia		Normal			
	No.	%	No.	%	No.	%
Present	7	41.18	10	58.82	17	17.00
Absent	31	37.35	52	62.65	83	83.00
Total	**38**	**38.00**	**62**	**62.00**	**100**	**100.00**

p = 0.789

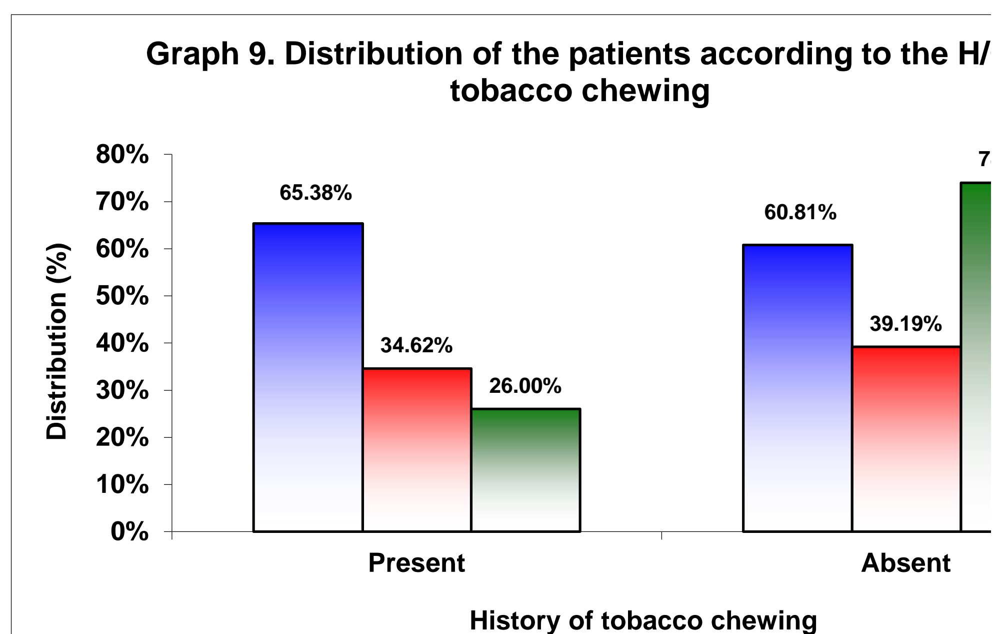


In the present study history of alcohol consumption was reported by 17% of the patients. Of which, 41.18% of the patients had hyperuricemia. However no association was found between hyperuricemia and history of alcohol consumption (p=0.789).

Table 12. Distribution of the patients according to the H/O tobacco chewing and its association with SUA

History of tobacco chewing	Serum Uric acid levels				Total (n=100)	
	Hyperuricemia		Normal			
	No.	%	No.	%	No.	%
Present	9	34.62	17	65.38	26	26.00
Absent	29	39.19	45	60.81	74	74.00
Total	**38**	**38.00**	**62**	**62.00**	**100**	**100.00**

p = 0.815

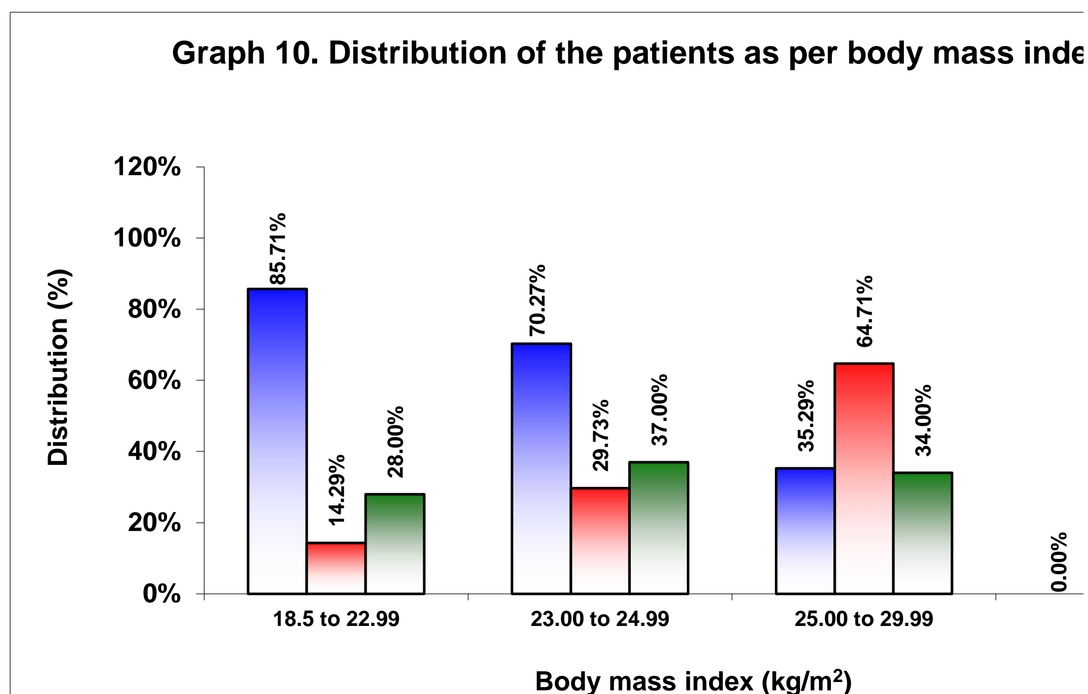


In this study history of tobacco chewing was reported by 26% of the patients. Of which, 34.62% of the patients had hyperuricemia. However no association was found between hyperuricemia and history of tobacco chewing (p=0.815).

Table 13. Distribution of the patients as per BMI and its association with SUA

Body mass index (kg/m^2)	Serum Uric acid levels				Total (n=100)	
	Hyperuricemia		Normal			
	No.	%	No.	%	No.	%
18.5 to 22.99	4	14.29	24	85.71	28	28.00
23.00 to 24.99	11	29.73	26	70.27	37	37.00
25.00 to 29.99	22	64.71	12	35.29	34	34.00
30	1	100.00	0	0.00	1	1.00
Total	**38**	**38.00**	**62**	**62.00**	**100**	**100.00**

$p<0.001$

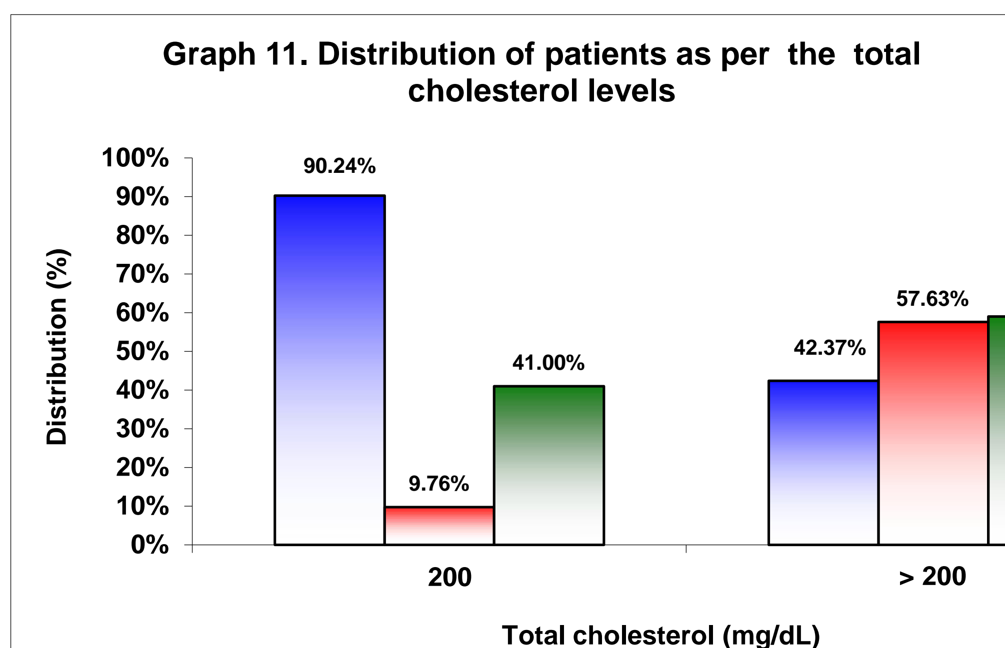


In our study most of the patients had BMI between 23.00 to 24.99 Kg/m^2 (37%). The frequency of hyperuricemia significantly increased in patients with BMI ranged between 23.00 to 24.99 Kg/m^2 (29.73%), 25.00 to 29.99 Kg/m^2 (64.71%) and 30 Kg/m^2 (100%) ($p<0.001$).

Table 14. Distribution of patients as per the total cholesterol levels and its association with SUA

Total cholesterol (mg/dL)	Serum Uric acid levels				Total (n=100)	
	Hyperuricemia		Normal			
	No.	%	No.	%	No.	%
200	4	9.76	37	90.24	41	41.00
> 200	34	57.63	25	42.37	59	59.00
Total	**38**	**38.00**	**62**	**62.00**	**100**	**100.00**

p<0.001

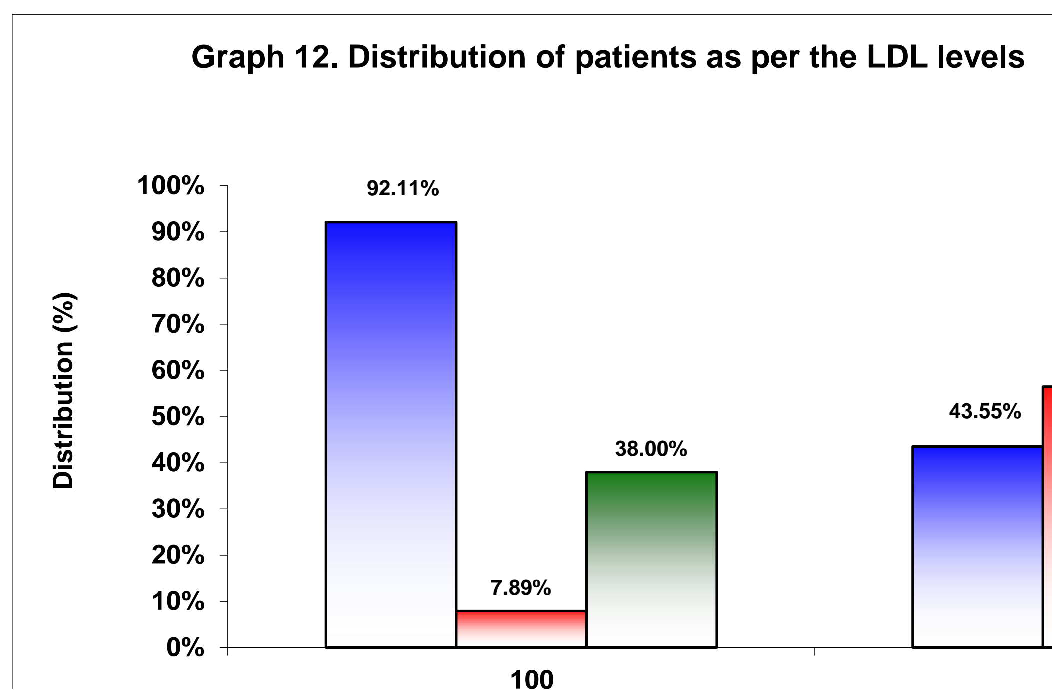


In this study elevated total cholesterol levels (>200 mg/dL) were noted in 59% of the patients. Among them significantly higher number of patients that is 57.63% had hyperuricemia (p<0.001).

Table 15. Distribution of patients as per the LDL levels and its association with SUA

LDL (mg/dL)	Serum Uric acid levels				Total (n=100)	
	Hyperuricemia		Normal			
	No.	%	No.	%	No.	%
100	3	7.89	35	92.11	38	38.00
> 100	35	56.45	27	43.55	62	62.00
Total	**38**	**38.00**	**62**	**62.00**	**100**	**100.00**

P < 0.001

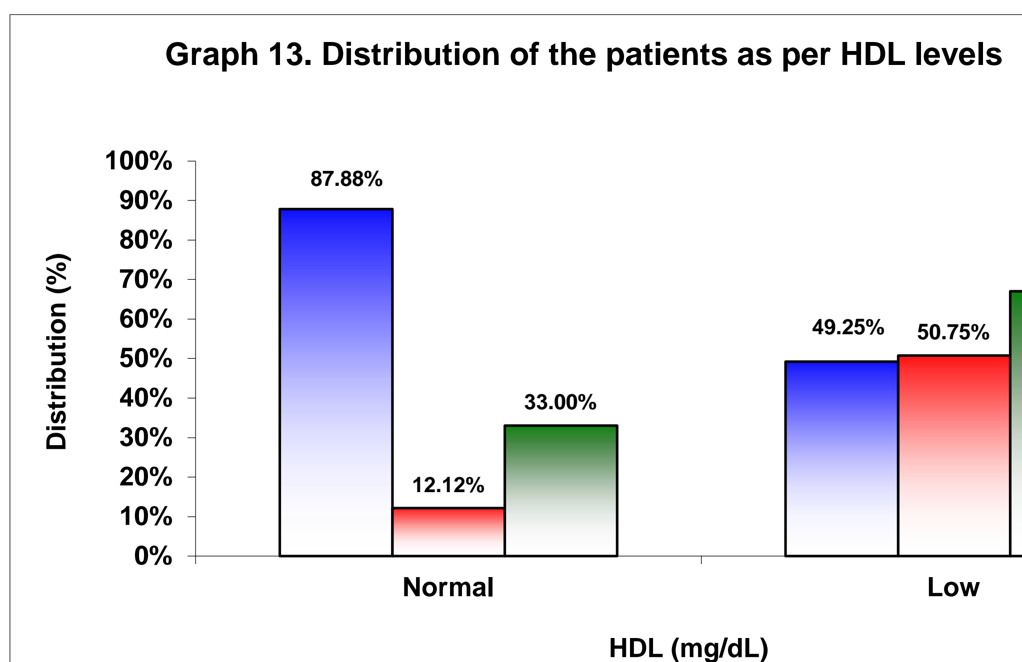


In the present study raised LDL levels (>100 mg/dL) were noted in 62% of the patients and significantly higher number of patients (56.45%) had hyperuricemia (p<0.001).

Table 16. Distribution of the patients as per HDL levels and its association with SUA

HDL (mg/dL)	Serum Uric acid levels				Total (n=100)	
	Hyperuricemia		Normal			
	No.	%	No.	%	No.	%
Normal	4	12.12	29	87.88	33	33.00
Low	34	50.75	33	49.25	67	67.00
Total	**38**	**38.00**	**62**	**62.00**	**100**	**100.00**

P < 0.001

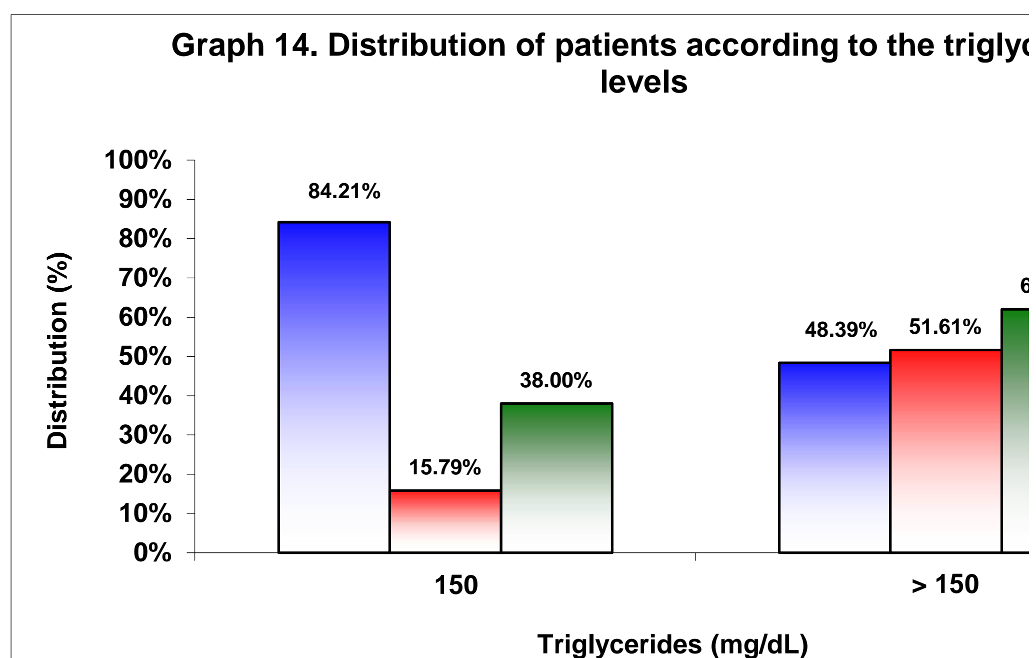


In this study abnormal HDL levels were noted in 67% of the patients. Among them significantly higher number of patients that is 50.75% had hyperuricemia (p<0.001).

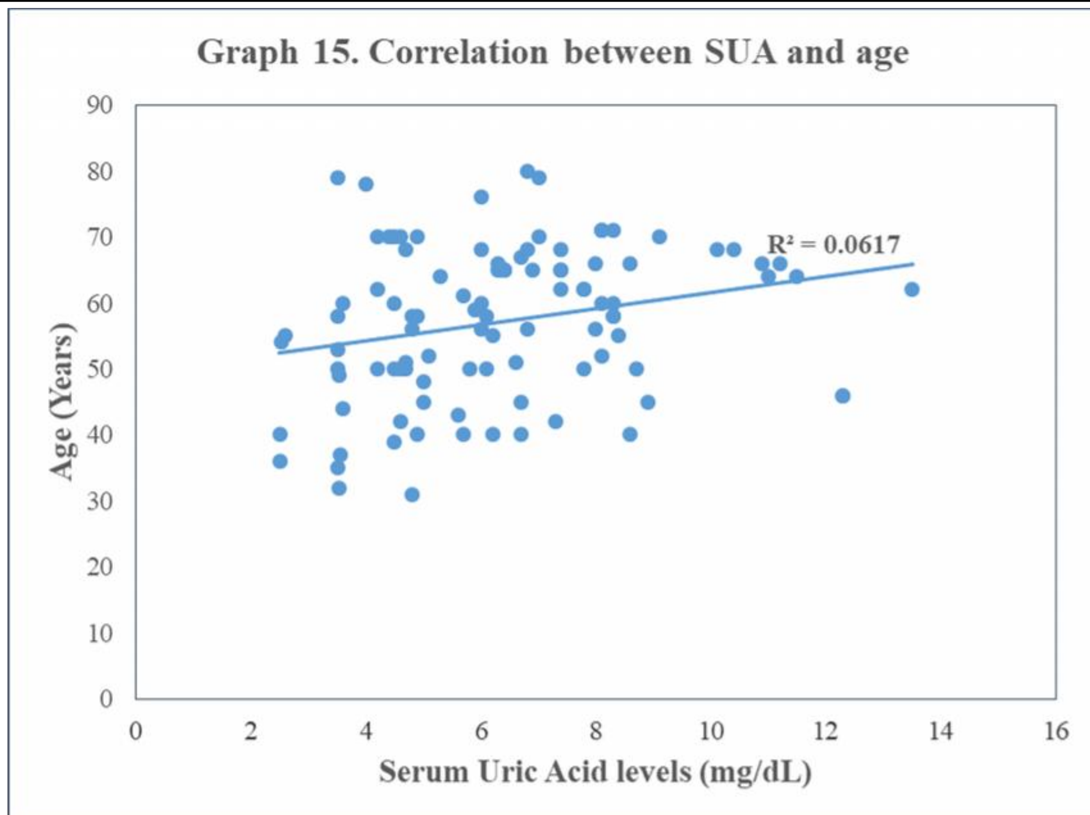
Table 17. Distribution of the patients as per Triglyceride levels and its association with SUA

Triglycerides (mg/dL)	Serum Uric acid levels				Total (n=100)	
	Hyperuricemia		Normal			
	No.	%	No.	%	No.	%
150	6	15.79	32	84.21	38	38.00
> 150	32	51.61	30	48.39	62	62.00
Total	**38**	**38.00**	**62**	**62.00**	**100**	**100.00**

P < 0.001

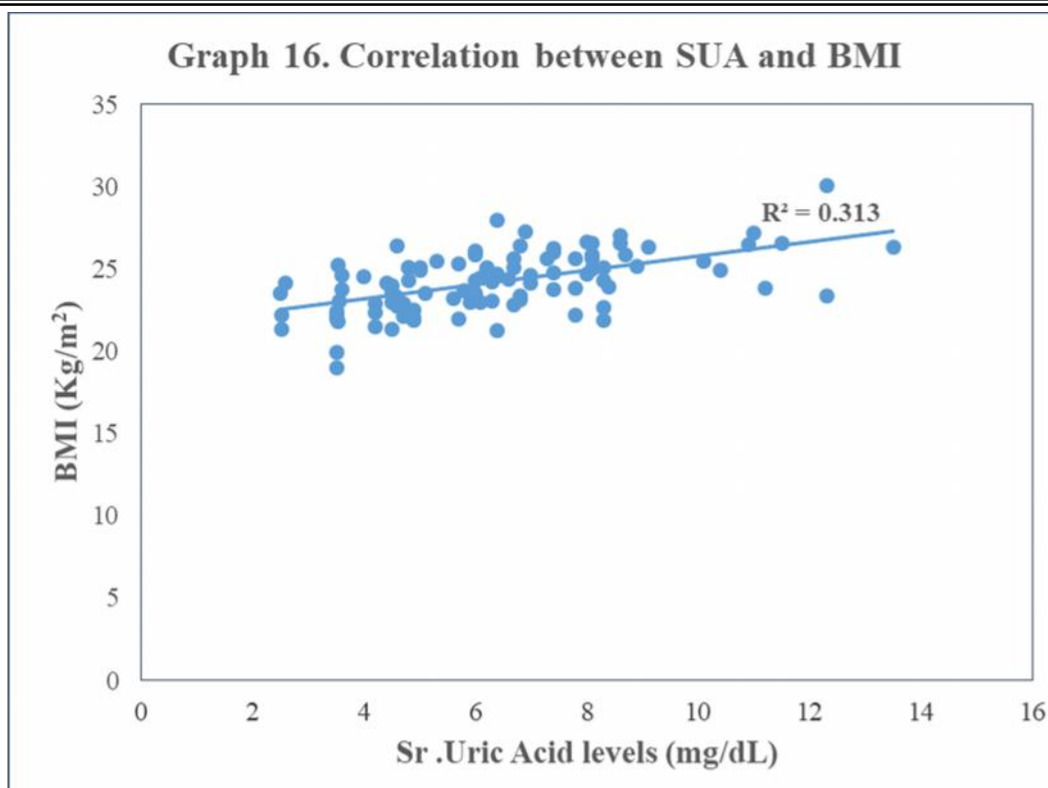


In the present study raised triglyceride levels (>150 mg/dL) were noted in 62% of the patients and significantly higher number of patients (51.61%) had hyperuricemia (p<0.001).



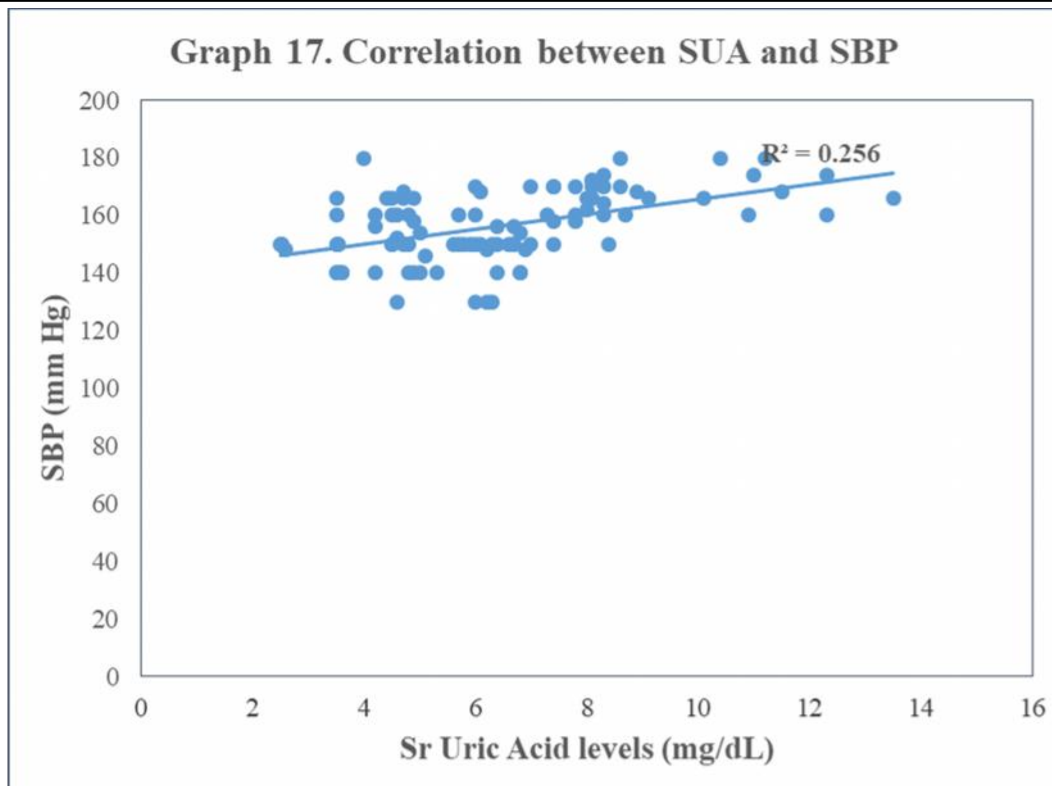
r = 0.248; R^2= 0.0617; p=0.013

In this study significant weak positive correlation was seen between age and sr. uric acid levels (r=0.248; R^2= 0.0617; p=0.013).



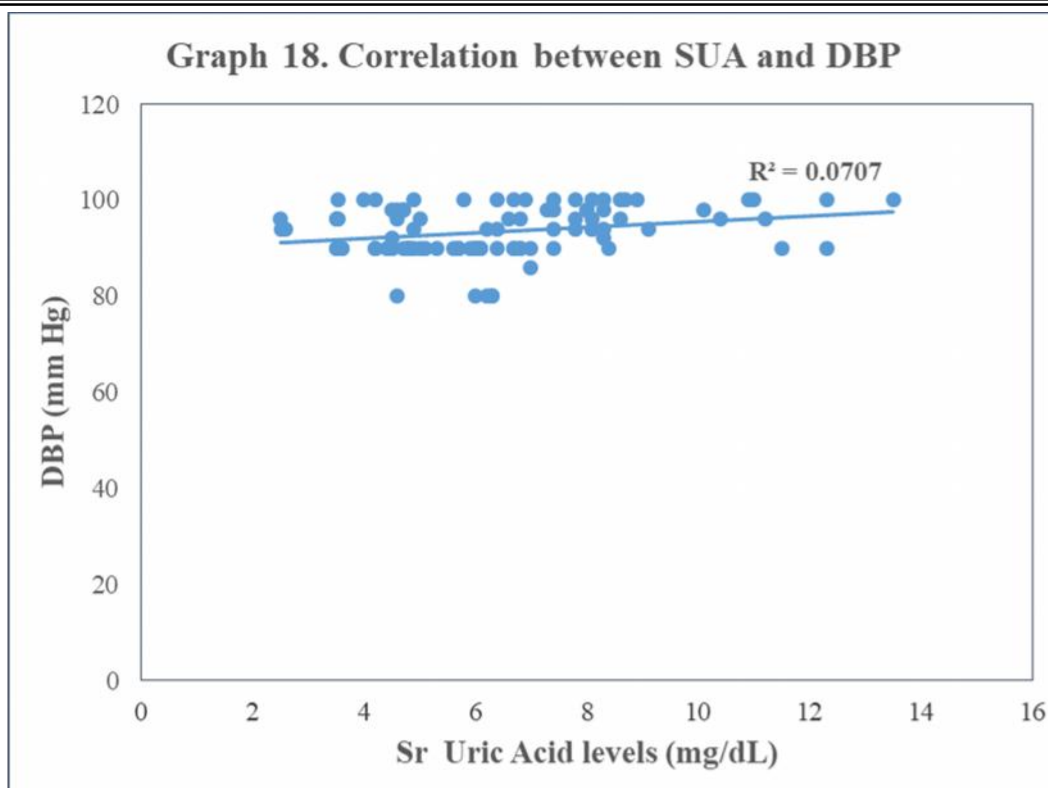
r=0.559; R^2= 0.313; p<0.001

In the present study significant moderate positive correlation was seen between BMI and sr.uric acid levels (r=0.559; R^2= 0.313; p<0.001).



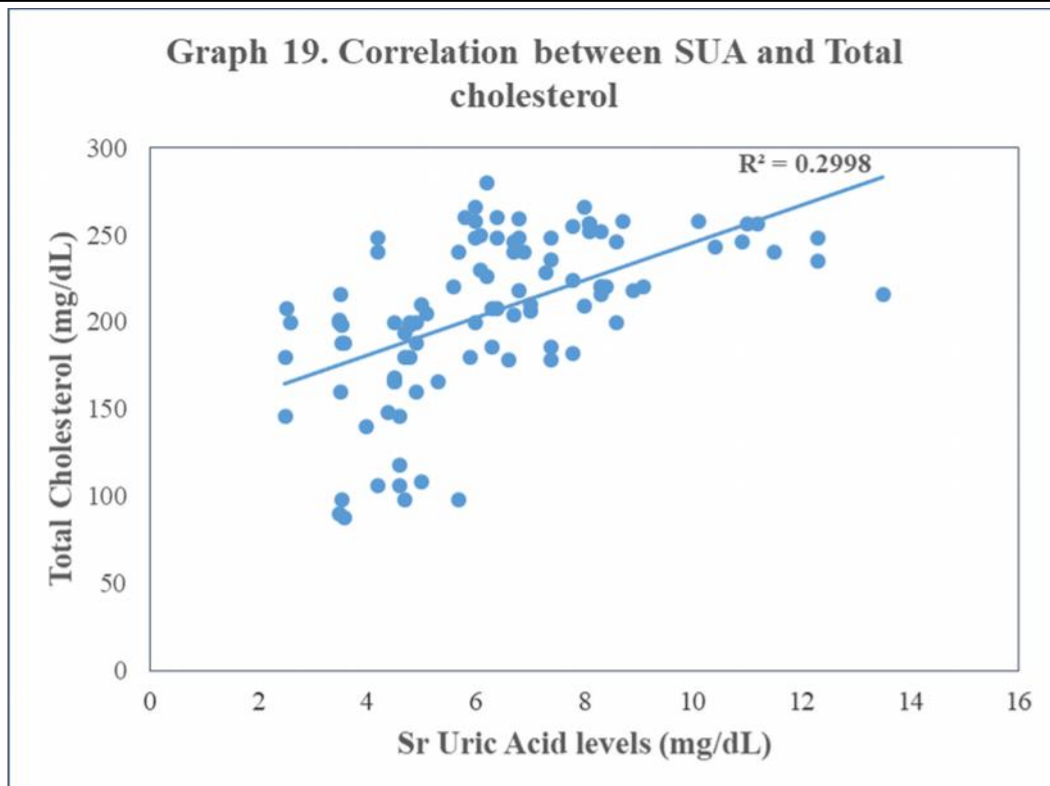
r=0.506; R^2= 0.256; p<0.001

In this study significant moderate positive correlation was noted between SBP and sr. uric acid levels (r=0.506; R^2= 0.256; p<0.001).



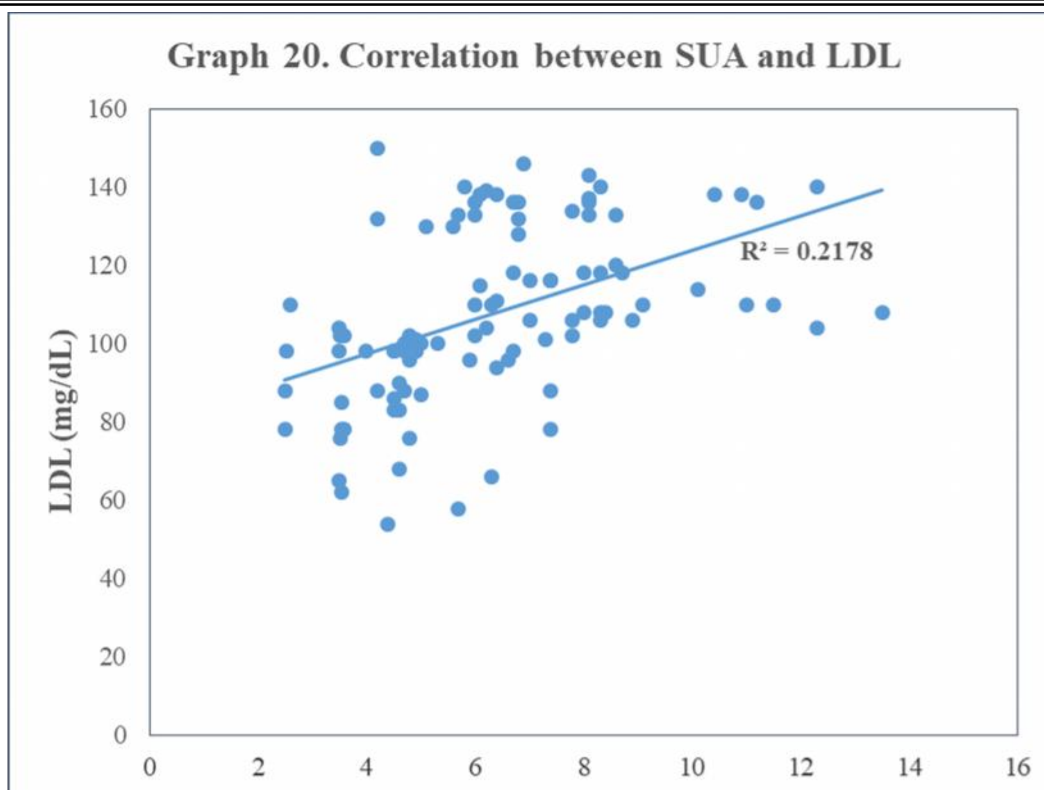
r=0.266; R^2= 0.0707; p=0.007

In the present study significant moderate positive correlation was noted between sr. uric acid levels and DBP (r=0.266; R^2= 0.707; p<0.001).



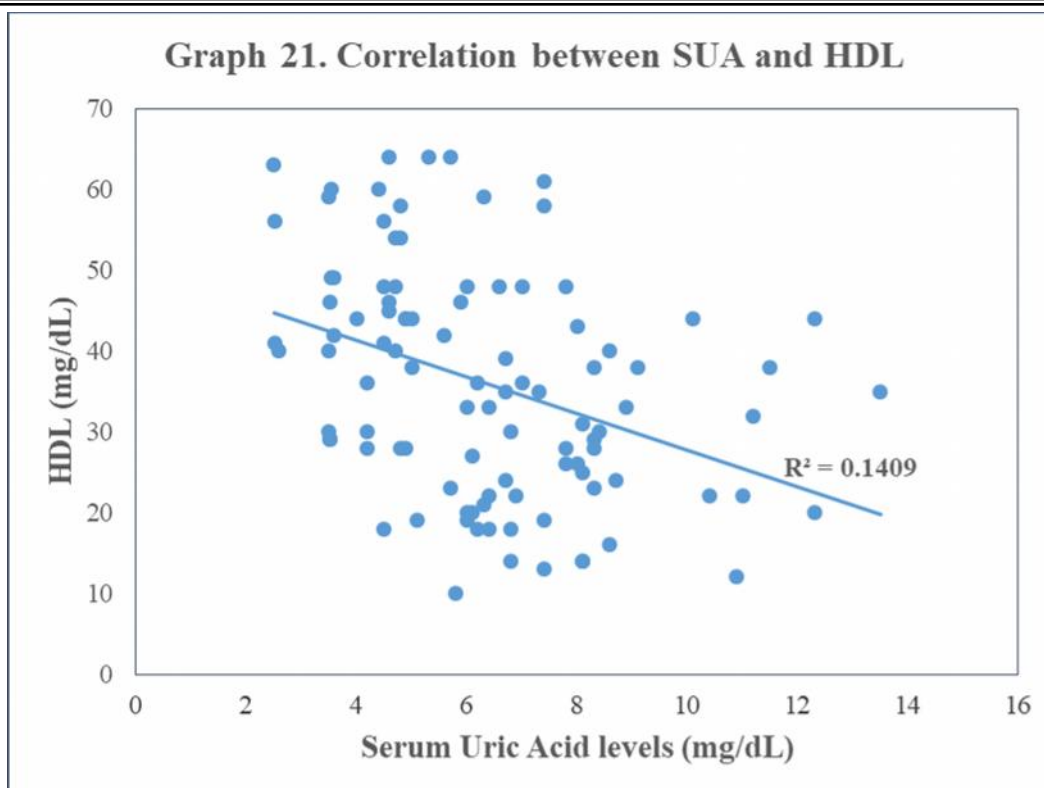
r=0.548; R^2= 0.299; p<0.001

In this study significant moderate positive correlation was noted between total cholesterol and sr uric acid levels (r=0.548; R^2= 0.299; p<0.001).



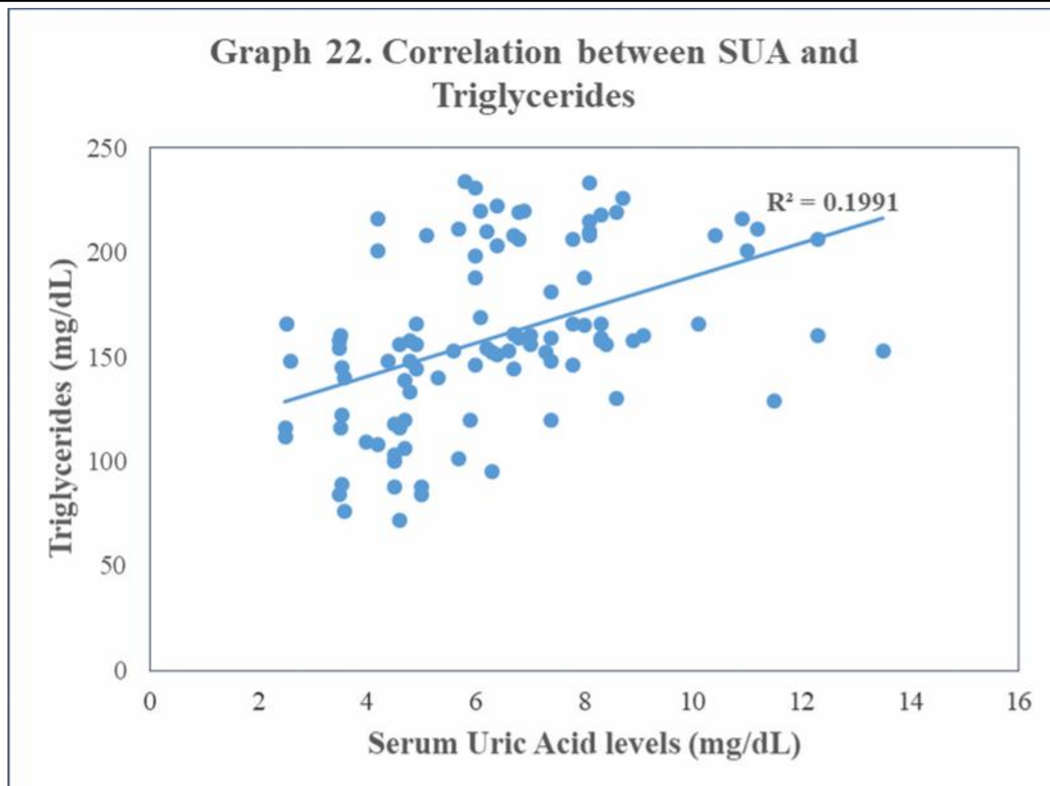
r=0.467; R^2= 0.2178; p=0.001

In the present study significant moderate positive correlation was noted between serum uric acid levels and LDL (r=0.467; R^2= 0.217; p<0.001).



r= -0.375; R^2= 0.1409; p=0.001

In this study significant weak negative correlation was noted between serum uric acid levels and HDL (r=0.375; R^2= 0.140; p<0.001).



r=0.446; R^2= 0.199; p=0.013

In the present study significant moderate positive correlation was noted between triglycerides and serum uric acid levels (r=0.446; R^2= 0.199; p=0.013).

DISCUSSION

Hypertension is a major public health problem not only in India but in other countries as well. There is strong association between BP and the risk of cardiovascular disease (MI, heart failure), renal disease and stroke leading to mortality and morbidity. Different studies shows the association between hypertension and serum uric acid level. Also elevated SUA levels are associated with an increased risk for cardiovascular disease. Metabolic syndrome, diabetes mellitus, chronic kidney disease, obesity, alcohol consumption, salt intake, fluid volume status are the numerous common risk factors for hypertension and hyperuricemia as well leading to cardiovascular disease. There are many factors which are associated with hypertension hence it is difficult to predict the cause for hypertension.[69] The present study was an attempt to find the relationship between serum uric acid levels and primary hypertension.

This one year hospital based cross sectional study was carried out from January 2018 to December 2018 in the Department of General Medicine, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi. A total of 100 patients with newly diagnosed primary hypertension were enrolled. Patients were evaluated for severity of hypertension and SUA levels.

In the present study the SUA levels ranged between 2.50 to as high as 13.50 mg/dL. The mean (6.36±2.33 mg/dL) and median SUA levels (6.15 mg/dL) were close to the higher borderline normal reference range. However, more than one third (38%) of the patients has elevated serum uric acid levels. Considering normal reference range among males between 3.5 to 7.2 mg/dL and 2.5 to 6.5 mg/dL among

females. Which translates into as high as every one patient out of three with HTN had hyperuricemia. The mean serum uric acids levels noted in our study were comparable to a recent case-control study done by Mishra A et al.[7] (2017) where the mean SUA level was 5.80±2.16 mg/dL in patients with newly diagnosed essential hypertension. The mean uric acid level in patients with newly diagnosed primary hypertension by Feiget al. (2008) were similar to the present study. (6.9 mg/dL).

In this study the SBP levels ranged between 130 to as high as 180 mm Hg and DBP levels ranged between 80 to 100 mm Hg. The mean and median SBP levels were very high (156.16±12.09 and 156 mm Hg respectively). The mean and median DBP levels were also very high (93.46±5.05 and 94 mm Hg respectively). The mean SBP levels in a recent case-control study by Mishra A et al.[7] (2017) were (159.00 ±11.98 mm Hg) and the mean DBP levels were (94±4.62 mm Hg) which was comparable with the present study.

Furthermore, the higher mean and median SBP as well as DBP in the present study was reflected on severity of the HTN as majority of the patients (96%) had stage II HTN and only 4% of the patients were diagnosed to have stage I HTN. Although 39.58% all the patients with stage II HTN had hyperuricemia and none of the patient (0%) with stage I HTN had hyperuricemia there was lack of association between HTN and hyperuricemia ($p=0.142$). However, the mean SBP (163.89±9.99 vs 151.41±10.78 mm Hg; $p<0.001$) and DBP (95.89±3.83 vs 91.96±5.15 mm Hg; $p<0.001$) were significantly high in hyperuricemic patients compared to those patients who has normal serum uric acid levels suggesting that patients with raised SUA levels are likely to present with elevated SBP and DBP. This observation was further strong we correlated serum uric acid levels with SBP and DBP which

showed significant moderate positive correlation between serum uric acid levels and SBP (r=0.506; R^2=0.256; p<0.001) and significant moderate positive correlation between SUA levels and DBP (r=0.266; R^2=0.707; p<0.001) as well. Hence it is evident that, every one patient out of three with HTN is likely to have raised serum uric acid levels and there is strong association between SUA with both SBP and DBP. This observation was consistent with several other studies by in the literature. The association of raised serum uric acid level and hypertension was documented since 1950 but received less attention because of lack of explanation. Raised serum uric acid is a risk factor for hypertension was reported by Kahn HA et al.[63] in 1990. According to this study 25-40% of adults with hypertension have serum uric acid more than 6.5 mg/dl and there was direct relationship between serum UA and SBP a finding consistent with the present study. The evaluation of subset from Framingham Heart Study by Kahn HA et al.[63] (1990) also showed that SUA level was an independent predictor of hypertension and progression of blood pressure over four years and an elevated UA level consistently predicts the development of hypertension. Feig DI and Johnson RJ.[10] (2003) reported that, an elevated UA level was observed in 25-60% of patients with untreated essential hypertension and in nearly 90% of adolescents with essential hypertension of recent onset. Most recently Poudel B. et al.[69] (2014) in their cross sectional case control study showed the positive association between hypertension and hyperuricemia. According to the study 28.8% of patients had elevated serum uric acid levels with hypertension with a mean level of SUA in hypertension and control were as 290.05±87.05 µmol/L and 245.24±99.38 µmol/L with (P<0.001). Despite the methodological differences the present study supports the findings of the study by Poudel B. et al.[69] (2014).

Another recent case-control study by Mishra A et al.[7] (2017) reported that, as compared to normal population prevalence of hyperuricemia in newly diagnosed primary hypertension was high. systolic blood pressure (r=0.367) and diastolic blood pressure (r=0.302) were associated with raised serum uric acid level and it was statistically significant (p value<0.05). Again despite of methodological differences the present study is strongly in agreement with the study by Mishra A et al.[7] (2017).

Although there is lack of association between serum uric acid levels with hypertension severity noted in the present study, it can be explained by the smaller subset of patients with stage I HTN. The smaller subset of patients with stage I HTN also reflected on the mean SUA levels which were profoundly high in patients with stage II primary HTN (6.38±2.37 mg/dL) compared to those who has stage I primary HTN (5.77±0.79 mg/dL) but the results were statistically not significant (p=0.238).

In our study majority of patients were males (68%) and 32% of the patients were female. The male to female ratio was 2.12:1 suggesting higher risk of primary HTN among males. However, the frequency of hyperuricemia was slightly high among females compared to males (43.75% vs 35.29%; p=0.142). But, the difference was statistically not significant. Also the mean serum uric acid levels were slightly high among male patients compared to female patients (6.43±2.24 vs 6.21±2.55 mg/dL) but again the difference was statistically not significant (p=0.670). these findings suggest that, the elevated serum uric acid levels in patients with primary hypertension are independent of sex. In contrast to these observations, Anand NN et al.[8] (2015) in their case control study, reported that, higher degree of hyperuricemia was seen in males as compared to females in hypertensive patients

In the present study the youngest patient was 31 years old and eldest patient was 80 years old. The mean age was 57.22±11.46 years and median age was 58 years suggestive of involvement of patient with fifth decade. However, most of the patients were aged between 61 to 70 years suggesting involvement of patient with seventh decade (35%). However no association was found between hyperuricemia and age (p=0.088). Further, significant weak positive correlation noted between serum uric acid levels and age (r=0.248; R^2=0.0617; p=0.013). Although these obervation of pose a link between elevated serum uric acid levels with age in patients with primary HTN but they require further validation in view of the lack of association between hyperuricemia and age and the weak nature of the correlation. These observations were partly same as with a study done by Cheng W et al.[56] (2017) who found that, SUA concentration was positively associated with hypertension only in the 41- to 50-year-old group.

In this study with regard to personal history, history of tobacco chewing was reported by 26% of the patients and a small subset of patients presented with history of smoking (15%) and history of alcohol consumption (17%) however, no association was found between elevated serum uric acid level with personal history of smoking (33.33%, p=0.779), alcohol consumption (41.18%< p=0.789) and tobacco chewing (34.62%, p=0.815) as well. Anand NN et al.[8] (2015) in their case control study reported that, there is no significant difference among hypertensive males with regard to UA and smoking. Smoking does not show an influence on hyperuricemia. A finding partly in agreement with our study.

In the present study maximum number of patients had BMI between 23.00 to 24.99 Kg/m^2 (37%). The mean BMI was 24.20±1.81 Kg/m^2 and median BMI levels

were 24.25 Kg/m^2 suggesting most of the patients with BMI levels suggestive of at risk of obesity. However, most of the patients (37%) had BMI levels between 23.00 to 24.99 Kg/m^2 suggestive od at risk of obesity. Further, the frequency of hyperuricemia increased in patients with BMI ranged between 23.00 to 24.99 Kg/m^2 (29.73%), 25.00 to 29.99 Kg/m^2 (64.71%) and >30 Kg/m^2 (100%) compared to those who present with normal BMI (18.5 to 22.99 Kg/m^2) (14.29%) and the difference observed was statistically significant ($p<0.001$) strong association between elevated serum uric acid levels with body mass index. Also significant moderate positive correlation noted between SUA and BMI ($r=0.559$; $R^2= 0.313$; $p<0.001$). These findings demonstrate strong relationship between BMI and hyperuricemia. On the contrary to the observations of the present study, Anand NN et al.[8] (2015) in their case control study reported that, though mean UA is higher in study subjects whose BMI > 25 than those subjects with BMI < 25, the association is not significant.

In this study total cholesterol levels ranged between 88 to 280 mg/dL. The mean and median total cholesterol levels were noted as 206±46.11 mg/dL and 210 mg/dL suggestive of hypercholesterolemia. Further, raised total cholesterol levels (>200 mg/dL) was seen in majority of the patients (59%). There was strong association between hypercholesterolemia and hyperuricemia as 57.63% of the patients with raised total cholesterol levels had hyperuricemia ($p<0.001$). Also significant moderate positive correlation noted between SUA levels and total cholesterol ($r=0.548$; $R^2=0.299$; $p<0.001$). these findings suggest significant relationship between total cholesterol levels and hyperuricemia.

In the present study LDL levels ranged between 54 to 150 mg/dL. The mean and median LDL levels were suggestive of raised LDL levels that is 107.72±22.12 mg/dL and 106 mg/dL respectively. Accordingly, raised LDL levels (>100 mg/dL) were noted in majority of the (62%) patients. There was strong association between raised LDL levels with hyperuricemia as 54.65% of the patients with elevated LDL had hyperuricemia ($p<0.001$). Also significant moderate positive correlation noted between SUA levels and LDL ($r=0.467$; $R^2= 0.217$; $p<0.001$). Again these finding pose strong risk of elevated LDL levels in patients with hyperuricemia presenting with primary HTN.

In this study HDL levels ranged between 10 to 64 mg/dL. The mean and median HDL levels were suggestive of lower than the normal reference range (35.94±14.16 mg/dL and 35.50 mg/dL). Majority of the patients had lower HDL levels (67%) and significantly higher number of patients with lower LDL levels (50.75%) had hyperuricemia ($p<0.001$) suggesting strong association between hyperuricemia with lower HDL levels. Also significant weak negative correlation noted between SUA levels and HDL ($r=-0.375$; $R^2= 0.140$; $p<0.001$). These observation prompt strong relationship between with lower LDL levels and hyperuricemia.

In the present study triglyceride levels ranged between 72 to 234 mg/dL. The mean and median triglyceride levels were suggestive of hypertriglyceridemia (159.52±41.71 mg/dl and 157.00 mg/dL respectively) accordingly raised triglyceride levels were noted in 62% of the patients and significantly higher number of patients with hypertriglyceridemia (51.61%) had hyperuricemia ($p<0.001$). Also significant moderate positive correlation noted between uric acid levels and triglycerides

(r=0.446; R^2=0.199; p=0.013). These finding suggest that, hyperuricemia is significantly associated with hypertriglyceridemia.

The present study showed not only strong association between hyperlipidemia but also strong correlation between raised serum uric acid levels and lipids. This observation from the present study could not be compared direclty with the other studies in the literature, Anand NN et al.[8] (2015) in their case control study reported that, Hyperuricemia is associated with metabolic syndrome as evidenced by other studies a finding partly in agreement with the present study as lipids are the important part of diagnosis of metabolic syndrome. In another study by Poudel B et al.[69] (2014) a positive association between the serum uric acid level and newly diagnosed hypertension was found.

Overall, the present study showed that, patients with primary HTN are likely to present with elevated serum uric acid levels and there is strong association between serum uric acid levels and SBP and DBP. Furthermore, hyperuricemia significantly associated with BMI, total cholesterol, LDL, HDL and triglycerides. Although there is direct correlation between serum uric acid levels with age, due to lack of association and weak positive correlation this observation requires further validation.

The present study not only looked for the association between the various parameters and elevated serum uric acid levels but also determined correlation which was the strength of the study. The limitations of the study were relatively smaller sample size and single centre study design. Also the present study predominantly involved male patients and stage II primary hypertension patients and

confounding factors couldn't be ruled out appropriately. Further multicentric studies involving gender specific and stage specific large sample size would provide more insights on the relationship between serum uric acid and primary hypertension.

CONCLUSION

Based on the findings of our study it may be concluded that, patients with primary HTN are likely to present with elevated serum uric acid levels and there is strong association between elevated serum uric acid levels with SBP and DBP. Furthermore, elevated serum uric acid levels are significantly associated with BMI and hyperlipidemia. However the hyperuricemia in patients with primary HTN is independent of sex and age.

SUMMARY

It is reported that, there is association between serum uric acid levels and hypertension. The aim of this study is to evaluate the relationship between serum uric acid levels and primary hypertension.

This one year hospital based cross sectional study was conducted from January 2018 to December 2018 in the Department of General Medicine, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi. A total of 100 patients with primary hypertension were enrolled. These patients were evaluated for serum uric acid levels and severity of HTN based on 2017 ACC/AHA guidelines. The salient findings of the study are summarized as below.

- The SUA levels ranged between 2.50 to 13.50 mg/dL. The mean SUA levels were noted as 6.36±2.33 mg/dL and median levels were noted as 6.15 mg/dL. Raised SUA levels that is hyperuricemia was noted in 38% of the patients.

- The SBP levels ranged between 130 to 180 mm Hg and DBP levels ranged between 80 to 100 mm Hg. The mean and median SBP levels were noted as 156.16±12.09 and 156 mm Hg. The mean and median DBP levels were noted as 93.46±5.05 and 94 mm Hg.

- The mean SBP (163.89±9.99 vs 151.41±10.78 mm Hg; $p<0.001$) and DBP (95.89±3.83 vs 91.96±5.15 mm Hg; $p<0.001$) were significantly high in hyperuricaemic patients compared to those patients who has normal serum uric acid levels. Significant moderate positive correlation was noted between serum uric acid levels and SBP ($r=0.506$; $R^2= 0.256$; $p<0.001$) Also

significant moderate positive correlation was noted between serum uric acid levels and DBP (r=0.266; R^2= 0.707; p<0.001).

- Majority of the patients (96%) had stage II HTN and only 4% of the patients were diagnosed to have stage I HTN. Among the 39.58% of the patients with stage II HTN had hyperuricemia while none of the patient (0%) with stage I HTN had hyperuricemia (p=0.142). The mean serum uric acid levels were high in patients with stage II primary HTN (6.38±2.37 mg/dL) compared to those who has stage I primary HTN (5.77±0.79 mg/dL) (p=0.238).

- Majority of the patients were males (68%) and 32% of the patients were female. The male to female ratio was 2.12:1. The frequency of hyperuricemia was slightly high among females (43.75%) compared to males (35.29%). But, the difference observed was statistically not significant (p=0.142). The mean serum uric acid levels were slightly high among male patients (6.43±2.24 mg/dL) compared to female patients (6.21±2.55 mg/dL) (p=0.670).

- The age of the patients ranged between 31 to 80 years. The mean age was 57.22±11.46 years and median age was 58 years. Most of the patients were aged between 61 to 70 years (35%). No association was found between hyperuricemia and age (p=0.088). Significant weak positive correlation was noted between serum uric acid levels and age (r=0.248; R^2= 0.0617; p=0.013)

- History of tobacco chewing was reported by 26% of the patients and a small subset of patients presented with history of smoking (15%) and history of

alcohol consumption (17%) however, no association was found between elevated serum uric acid level with personal history of smoking (33.33%, $p=0.779$), alcohol consumption (41.18%< $p=0.789$) and tobacco chewing (34.62%, $p=0.815$).

- Most of the patients had BMI between 23.00 to 24.99 Kg/m^2 (37%). The frequency of hyperuricemia significantly increased in patients with BMI ranged between 23.00 to 24.99 Kg/m^2 (29.73%), 25.00 to 29.99 Kg/m^2 (64.71%) and >30 Kg/m^2 (100%) ($p<0.001$). Significant moderate positive correlation was noted between serum uric acid levels and BMI ($r=0.559$; $R^2= 0.313$; $p<0.001$).

- Elevated total cholesterol levels (>200 mg/dL) were noted in 59% of the patients. Among them significantly higher number of patients that is 57.63% had hyperuricemia ($p<0.001$). Moderate positive correlation was noted between serum uric acid levels and total cholesterol ($r=0.548$; $R^2= 0.299$; $p<0.001$).

- Raised LDL levels (>100 mg/dL) were noted in 62% of the patients and significantly higher number of patients (56.45%) had hyperuricemia ($p<0.001$). Significant moderate positive correlation was noted between serum uric acid levels and LDL ($r=0.467$; $R^2= 0.217$; $p<0.001$).

- Abnormal HDL levels were noted in 67% of the patients. Among them significantly higher number of patients that is 50.75% had hyperuricemia ($p<0.001$). significant moderate positive correlation was noted between serum uric acid levels and HDL ($r=0.467$; $R^2= 0.217$; $p<0.001$).

- Raised triglyceride levels (>150 mg/dL) were noted in 62% of the patients and significantly higher number of patients (51.61%) had hyperuricemia ($p<0.001$). Significant moderate positive correlation was noted between serum uric acid levels and triglycerides ($r=0.446$; $R^2= 0.199$; $p=0.013$).

Overall the present study showed that, strong correlation between serum uric acid with SBP and DBP in patients with primary HTN.

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ANNEXURE I – INFORMED COSNENT FORM

TITLE OF THE RESEARCH: "EVALUATION OF SERUM URIC ACID LEVEL IN PRIMARY HYPERTENSION – A ONE YEAR CROSS SECTIONAL STUDY"

Principal investigator

Dr. **** ******* *******
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Guide,
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Introduction and purpose

This research is intended to evaluate the relationship between serum uric acid and primary hypertension the principal investigator of the study is **Dr. **** ****** ********* under the guidance of **Dr ***** ****** ** Associate Professor, Department of General Medicine, Jawaharlal Nehru Medical College, Nehru Nagar, Belagavi – 590 010

Procedure

If you agree to be part of the research study you will be subjected to relevant clinical examination and investigations. You will also have to give blood and urine samples for the necessary investigations.

Risk and Benefits

The only risk and possible discomfort you might get is while taking blood from you for the investigations. It may cause swelling, pain, redness, (rarely happens) at the site from where the blood is drawn. You may be benefitted by these investigations but you will be part of this study which is going to be useful to others in the future.

Alternatives

Taking part in this study is voluntary. You may choose not to take part in this study, or if you decide to take part you can later change my mind and withdraw from the study. Your decision will not change the present or future health care or other services that you receive. The study doctor or sponsorer may stop your participation in this study any time. If you choose not to take part in the study you will receive the standard treatment for patients with your condition.

Privacy and Confidentiality

All information collected about you during the course of this study will be kept confidential to the extent permitted by law. The code numbers will identify you in this research record. Information from this study may be published but your identity will be confidential in any publication.

Institution / Sponsor’s policy

Does not apply to this research.

Financial incentives for participation

You will not be paid / offered any gifts /incentives for participating in the study.

Authorization to publish the results

The results of the study would be forwarded to the KLE University, Belagavi as part of requirement towards the completion of MD degree, review and publishing.

Questions

If you have any questions about study you may call In case of queries regarding your right as a participant you may contact:

Dr. ***** ******
Associate Professor,
Department of General Medicine,
JNMC, Belagavi.
Phone No: ***** *****

Dr **** ****** *******
Post graduate student,
Department of General Medicine,
JNMC, Belagavi
Phone No.: ***** ******

Dr. **** ** ******,
Chairman, J.N.M.C Ethical Committee for Human Research,
Professor and Head,
JNMC Belagavi
Phone number: ***** *****

CONSENT FORM

I voluntarily agree to take part in this study by signing on the line below. I am not giving up any of my legal rights by signing this form. My signature below indicated that I have read this entire consent form or it has been read to me, and has been explained to me in my vernacular language and had all my questions answered. I will be given a copy of this consent form.

Signature /Left Thumb print of the Participant or legally authorized representative.

Participant's Name : ………………………………….

Signature/ Left Thumb Impression of the participant: ………………………………….

Name of the legally authorized representative/ Guardian : ………………………………….

Signature/ Left Thumb Impression. : ………………………………….

Witness's Name : ………………………………….

Signature/ Left Thumb Impression. :…………………………….

Investigators name and Signature : ………………………………….

Date:

Place:

ANNEXURE II – ETHICAL CLEARANCE LETTER

K.L.E.UNIVERSITY'S

JAWAHARLAL NEHRU MEDICAL COLLEGE,

NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)

(Accredited 'A' Grade by NAAC)

Website: http//www.jnmc.edu
E-Mail : dome@jnmc.edu

Phone: (+ 91-(0)831 Office : 2471350
Principal: 2471701
Fax No. +91 (0)831 – 2470759

Ref: MDC/DOME/ 43 **Date: 22/11/2017**

To,

PG student in Medicine,
J.N.Medical College,
BELAGAVI.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled **"EVALUATION OF SERUM URIC ACID LEVEL IN PRIMARY HYPERTENSION – A ONE YEAR CROSS SECTIONAL STUDY",** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr. Arathi Darshan)
Member Secretary
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

(Dr. Roopa M Bellad)
Chairman,
JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belagavi.

ANNEXURE III – PROFORMA

Name :

Age :

Sex :

Address :

Occupation :

History

Hypertension :

Diabetes mellitus :

Other comorbidities :

Habits :

General physical examination

Pulse rate :

<u>Blood pressure</u>

Systolic blood pressure (mm Hg) :

Diastolic blood pressure (mm Hg) :

Height (cms) ;

Weight (Kg) :

Body mass index (Kg/m^2) :

Systemic examination

Cardiovascular system :

Respiratory system :

Central nervous system :

Per abdomen :

Investigations

Serum uric acid (mg/dL) :

Haemoglobin (gm%) :

Total count (/cumm) :

Platelet count (Lakhs/cumm) :

Blood urea (mg/dL) :

Serum creatinine (mg/dL) :

TSH (mcIU/ml) :

Random blood sugar (mg/dL) :

Fasting Lipid profile

Total cholesterol (mg/dL) :

High density lipoprotein (mg/dL) :

Low density lipoprotein (mg/dL) :

Triglycerides (mg/dL) :

ANNEXURE IV – KEY TO MASTER CHART

BS	-	Business
Cms	-	Centimeters
Cumm	-	Cubic millimeters
F	-	Female
FR	-	Farmer
HW	-	House wife
Kg	-	Kilograms
M	-	Male
m	-	Meter
mg/dL	-	Milligrams per deciliter
mm Hg	-	Milligrams of mercury
N	-	No
SK	-	Skilled worker
SR	-	Service
TSH	-	Thyroid stimulating hormone
Y	-	Yes

ANNEXURE IV - MASTER CHART

					Past medical history							Personal history			Examination							Investigations											
Serial Number	In/Out Patient Number	Age (Years)	Sex	Occupation	Renal failure	Gout	Lymphoproliferative disorders	Myeloproliferative disorders	Pregancy induced hypertension	Diabetes mellitus	Thyroid disorders	Smoking	Alcohol consumption	Tobacco chewing	Height (cms)	Weight (Kg)	Body mass index (Kg/m^2)	Pulse rate (/Minute)	Respiratory rate (/Minute)	Systolic blood pressure (mm Hg)	Diastolic blood pressure (mm Hg)	Serum uric acid (mg/dL)	Serum uric acid (mg/dL)	Haemoglobin (gm%)	Total count (/Cumm)	Platelet count (/Cumm)	Serum urea (mg/dL)	Serum Creatinine (mg/dL)	Random blood sugar (mg/dL)	TSH (mcIU/ml)	Total Cholesterol (mg/dL)	Low density lipoprotein (mg/dL)	High density lipoprotein (mg/dL)
1	871831	59	F	HW	N	N	N	N	N	N	N	N	N	N	163	61	22.96	86	20	150	90	5.90	NUA	9.90	15300	214	19	1.01	128	0.80	180	96	46
2	909966	64	M	FR	N	N	N	N	N	N	N	N	N	N	156	62	25.48	80	18	140	90	5.30	NUA	12.20	4500	222	38	0.90	131	1.50	166	100	64
3	1861710	68	M	FR	N	N	N	N	N	N	N	N	N	N	167	72	25.82	88	18	160	90	6.00	NUA	17.00	9400	119	32	0.94	119	2.00	258	102	48
4	872584	66	F	HW	N	N	N	N	N	N	N	N	N	N	152	63	27.05	90	16	170	100	8.60	HUA	12.40	7040	153	25	1.10	100	2.50	200	120	40
5	872548	70	M	FR	N	N	N	N	N	N	N	Y	Y	N	162	60	22.86	84	18	160	100	4.20	NUA	15.40	7330	195	19	1.00	154	2.80	106	88	36
6	872836	65	F	HW	N	N	N	N	N	N	N	N	N	N	166	75	27.22	82	20	148	100	6.90	HUA	12.00	13460	126	44	1.10	140	2.00	240	146	22
7	872351	40	M	FR	N	N	N	N	N	N	N	N	N	N	158	55	22.03	88	18	166	100	4.90	NUA	17.90	6040	172	15	0.90	144	1.20	160	98	44
8	876522	31	M	FR	N	N	N	N	N	N	N	N	Y	N	161	63	24.30	86	20	160	90	4.80	NUA	16.10	4630	176	21	0.80	116	1.00	200	102	28
9	874154	70	F	HW	N	N	N	N	N	Y	N	N	N	N	151	60	26.31	90	20	166	94	9.10	HUA	12.90	8970	281	48	0.90	160	0.80	220	110	38
10	872252	70	M	FR	N	N	N	N	N	Y	N	N	N	N	160	56	21.88	88	18	158	94	4.90	NUA	8.40	5950	234	39	1.10	158	2.60	188	98	44
11	871882	55	F	HW	N	N	N	N	N	N	N	N	N	N	155	58	23.93	88	20	150	90	8.40	HUA	11.80	10090	261	28	0.90	136	2.00	220	108	30
12	871457	68	M	FR	N	N	N	N	N	N	N	Y	N	N	154	55	23.11	80	22	154	96	6.80	NUA	12.00	12000	298	18	1.00	122	3.00	259	132	14
13	871527	56	M	FR	N	N	N	N	N	Y	N	Y	N	N	156	60	24.65	70	18	162	98	8.00	HUA	11.00	8600	242	22	0.98	166	3.20	266	118	26
14	889514	50	M	SR	N	N	N	N	N	N	N	N	N	Y	159	58	22.94	80	22	160	92	4.50	NUA	16.70	15590	246	16	0.70	122	2.80	166	98	56
15	871757	68	F	HW	N	N	N	N	N	N	N	N	N	N	149	57	25.45	80	20	166	98	10.10	HUA	9.70	24000	188	26	1.10	143	2.40	258	114	44
16	870639	68	M	FR	N	N	N	N	N	N	N	N	N	Y	166	61	22.14	88	18	168	98	4.70	NUA	11.70	5660	426	26	0.80	144	2.50	98	98	40
17	870811	68	M	SR	N	N	N	N	N	Y	N	N	Y	N	162	65	24.88	70	20	180	96	10.40	HUA	15.30	10530	224	26	1.00	166	3.00	243	138	22
18	4564814	50	F	HW	N	N	N	N	N	N	N	N	N	Y	155	62	25.60	66	18	170	94	7.80	HUA	12.20	8670	531	26	1.00	140	3.40	182	102	48
19	4238408	55	F	HW	N	N	N	N	N	N	N	N	N	N	163	64	24.16	68	20	148	94	2.60	NUA	11.70	9090	313	24	0.90	144	2.80	200	110	40
20	848320	60	F	HW	N	N	N	N	N	Y	N	N	N	N	148	53	24.01	70	18	166	98	4.50	NUA	11.60	10610	305	42	1.20	168	2.50	200	98	18
21	848352	58	M	FR	N	N	N	N	N	N	N	N	Y	N	149	54	24.41	80	20	168	90	6.10	NUA	14.10	11280	254	36	1.00	144	2.40	250	138	20
22	864083	62	M	FR	N	N	N	N	N	N	N	N	N	N	164	60	22.31	88	18	156	90	4.20	NUA	14.20	5250	156	38	0.60	128	2.00	248	132	28

ANNEXURE IV - MASTER CHART

Serial Number	In/Out Patient Number	Age (Years)	Sex	Occupation	Past medical history							Personal history			Examination							Investigations												
					Renal failure	Gout	Lymphoproliferative disorders	Myeloproliferative disorders	Pregnancy induced hypertension	Diabetes mellitus	Thyroid disorders	Smoking	Alcohol consumption	Tobacco chewing	Height (cms)	Weight (Kg)	Body mass index (Kg/m^2)	Pulse rate (/Minute)	Respiratory rate (/Minute)	Systolic blood pressure (mm Hg)	Diastolic blood pressure (mm Hg)	Serum uric acid (mg/dL)	Serum uric acid (mg/dL)	Haemoglobin (gm%)	Total count (/Cumm)	Platelet count (/Cumm)	Serum urea (mg/dL)	Serum Creatinine (mg/dL)	Random blood sugar (mg/dL)	TSH (mcIU/ml)	Total Cholesterol (mg/dL)	Low density lipoprotein (mg/dL)	High density lipoprotein (mg/dL)
23	4602288	70	M	FR	N	N	N	N	N	Y	N	N	N	N	157	60	24.14	80	22	166	90	4.40	NUA	12.40	10020	217	35	1.00	162	1.80	148	54	60
24	884708	46	M	SR	N	N	N	N	N	N	N	N	Y	N	158	58	23.35	84	18	174	90	12.30	HUA	7.20	9140	418	25	0.60	134	1.60	248	140	20
25	888124	65	M	SR	N	N	N	N	N	Y	N	N	N	N	164	71	26.21	88	22	170	98	7.40	HUA	10.90	10170	204	26	1.10	146	1.40	178	78	58
26	890184	50	M	FR	N	N	N	N	N	N	N	N	N	Y	161	59	22.61	80	18	166	98	4.70	NUA	6.20	3500	151	16	0.15	134	1.20	180	100	48
27	891771	58	M	FR	N	N	N	N	N	Y	N	N	N	N	158	63	25.04	88	22	174	98	8.30	HUA	10.50	11540	226	42	0.40	156	2.80	220	118	28
28	890453	79	M	FR	N	N	N	N	N	N	N	N	N	N	154	57	24.12	80	18	150	90	7.00	NUA	8.40	9860	287	32	1.00	144	2.20	210	116	36
29	855465	52	M	SR	N	N	N	N	N	N	N	Y	N	N	159	60	23.54	84	20	146	90	5.10	NUA	14.70	11400	130	22	0.60	140	2.40	205	130	19
30	884708	46	M	FR	N	N	N	N	N	Y	N	N	Y	N	161	78	30.09	76	18	160	100	12.30	HUA	9.30	9900	492	25	0.80	180	2.90	235	104	44
31	888124	65	M	SR	N	N	N	N	N	Y	N	Y	N	N	166	66	23.77	70	16	170	90	7.40	HUA	7.40	10170	204	24	1.00	156	2.10	186	88	61
32	890184	50	M	SR	N	N	N	N	N	N	N	N	Y	N	153	61	25.84	72	18	160	100	8.70	HUA	6.90	19650	266	18	1.10	128	2.20	258	118	24
33	891771	58	M	BS	N	N	N	N	N	N	N	N	N	N	168	62	21.90	80	16	164	92	8.30	HUA	10.50	11540	226	41	0.60	140	2.80	252	140	23
34	890453	79	M	FR	N	N	N	N	N	Y	N	N	Y	N	166	55	19.96	80	18	140	90	3.50	NUA	8.40	9860	287	46	0.60	156	1.80	200	104	40
35	891164	60	M	SR	N	N	N	N	N	N	N	N	N	Y	168	69	24.27	88	20	170	94	8.30	HUA	13.30	5400	128	28	1.00	126	1.40	220	108	29
36	891226	78	M	FR	N	N	N	N	N	Y	N	N	N	Y	172	73	24.51	90	18	180	100	4.00	NUA	9.40	14000	338	18	1.00	138	1.60	140	98	44
37	894564	64	M	BS	N	N	N	N	N	N	N	N	N	N	165	74	27.18	80	16	174	100	11.00	HUA	13.60	5100	114	45	1.00	140	1.20	256	110	22
38	889327	56	F	SR	N	N	N	N	N	Y	N	N	N	N	170	73	25.09	80	18	140	90	4.80	NUA	15.00	14730	308	38	1.20	136	1.78	180	96	54
39	892304	70	M	FR	N	N	N	N	N	N	N	N	N	Y	158	62	24.64	86	22	170	90	7.00	NUA	10.60	5800	280	26	0.60	140	1.60	206	106	48
40	938958	51	F	HW	N	N	N	N	N	N	N	N	N	N	160	59	22.85	86	20	150	90	4.70	NUA	12.00	12000	289	45	0.40	130	2.40	194	88	54
41	879126	67	F	HW	N	N	N	N	N	N	N	N	N	N	161	67	25.65	80	18	156	90	6.70	HUA	11.00	5220	183	24	0.20	136	2.20	246	118	24
42	879090	80	F	HW	N	N	N	N	N	Y	N	N	N	N	159	67	26.42	90	18	140	90	6.80	HUA	11.20	10350	341	18	1.00	136	3.40	248	136	18
43	889003	56	F	HW	N	N	N	N	N	N	N	N	N	N	156	59	24.33	80	22	130	80	6.00	NUA	12.60	5600	260	19	0.90	130	2.80	200	110	20
44	896640	39	F	SR	N	N	N	N	N	N	N	N	N	N	162	62	23.62	80	18	150	90	4.50	NUA	11.30	13000	160	22	1.00	140	2.90	166	86	48

ANNEXURE IV - MASTER CHART

Serial Number	In/Out Patient Number	Age (Years)	Sex	Occupation	Past medical history							Personal history			Examination							Investigations											
					Renal failure	Gout	Lymphoproliferative disorders	Myeloproliferative disorders	Pregancy induced hypertension	Diabetes mellitus	Thyroid disorders	Smoking	Alcohol consumption	Tobacco chewing	Height (cms)	Weight (Kg)	Body mass index (Kg/m^2)	Pulse rate (/Minute)	Respiratory rate (/Minute)	Systolic blood pressure (mm Hg)	Diastolic blood pressure (mm Hg)	Serum uric acid (mg/dL)	Serum uric acid (mg/dL)	Haemoglobin (gm%)	Total count (/Cumm)	Platelet count (/Cumm)	Serum urea (mg/dL)	Serum Creatinine (mg/dL)	Random blood sugar (mg/dL)	TSH (mcIU/ml)	Total Cholesterol (mg/dL)	Low density lipoprotein (mg/dL)	High density lipoprotein (mg/dL)
45	915577	45	F	HW	N	N	N	N	N	N	N	N	N	N	159	63	24.92	90	18	140	90	5.00	NUA	12.10	7200	266	16	0.40	120	3.20	210	100	38
46	916944	40	F	HW	N	N	N	N	N	N	N	N	N	N	159	63	25.04	70	24	130	80	6.20	NUA	12.00	9200	200	14	0.38	100	3.40	226	104	36
47	898616	60	M	FR	N	N	N	N	N	Y	N	N	N	Y	165	67	24.61	68	22	140	90	3.60	NUA	11.00	8000	335	20	0.80	140	3.80	188	102	42
48	892066	52	M	FR	N	N	N	N	N	N	N	N	N	Y	155	62	25.89	62	24	166	100	8.10	HUA	13.30	10600	196	46	0.80	140	3.00	256	133	25
49	892083	44	M	FR	N	N	N	N	N	Y	N	N	Y	Y	163	63	23.71	68	26	140	90	3.60	NUA	9.60	5690	206	36	1.10	142	2.80	88	78	49
50	890741	50	M	FR	N	N	N	N	N	N	N	N	Y	Y	160	61	23.63	70	16	150	100	5.80	NUA	7.30	4160	150	50	1.00	111	2.00	260	140	10
51	890920	50	M	FR	N	N	N	N	N	N	N	Y	N	N	154	55	22.98	80	18	150	90	6.10	NUA	11.70	12200	391	45	1.20	130	2.60	230	115	27
52	898251	51	M	FR	N	N	N	N	N	N	N	N	N	Y	155	59	24.35	82	18	150	96	6.60	NUA	11.60	3300	180	20	1.20	118	2.20	178	96	48
53	909995	42	M	FR	N	N	N	N	N	N	N	N	N	N	160	66	25.59	80	24	160	98	7.30	HUA	13.00	3300	140	18	0.86	128	2.40	228	101	35
54	910008	58	M	BS	N	N	N	N	N	Y	N	N	N	Y	156	55	22.39	66	20	160	96	3.51	NUA	12.00	4600	222	24	1.10	138	3.20	160	76	46
55	899739	71	M	FR	N	N	N	N	N	Y	N	N	Y	Y	164	67	24.99	76	18	172	96	8.10	HUA	13.00	3600	140	19	0.86	144	1.80	256	137	14
56	5010525	40	M	FR	N	N	N	N	N	N	N	N	N	Y	160	68	26.56	80	20	180	96	8.60	HUA	10.60	4800	180	25	1.17	114	1.60	246	133	16
57	908458	62	M	FR	N	N	N	N	N	Y	N	N	N	N	172	71	23.83	88	18	158	96	7.80	HUA	11.00	5800	180	40	1.00	166	1.40	255	106	28
58	857342	45	M	SK	N	N	N	N	N	N	N	N	N	N	165	69	25.16	80	20	168	100	8.90	HUA	11.00	5600	120	40	0.96	130	1.60	218	106	33
59	907834	40	M	FR	N	N	N	N	N	N	N	N	N	N	161	57	21.99	72	18	150	90	5.70	NUA	11.00	3000	150	36	1.00	122	2.00	240	133	23
60	906166	58	M	FR	N	N	N	N	N	Y	N	Y	N	N	157	56	22.52	74	16	140	90	4.90	NUA	12.60	4900	140	16	0.86	130	2.20	200	101	28
61	902107	49	M	FR	N	N	N	N	N	Y	N	Y	N	N	158	55	21.83	70	18	150	96	3.53	NUA	9.60	3600	225	36	0.96	120	2.40	98	78	29
62	906261	76	M	BS	N	N	N	N	N	Y	N	Y	N	N	159	66	26.11	78	24	170	90	6.00	NUA	10.60	3600	160	36	0.90	111	2.40	266	133	33
63	920181	65	M	FR	N	N	N	N	N	N	N	Y	N	Y	160	63	24.69	88	20	150	100	6.40	NUA	12.60	5600	160	30	0.86	128	2.60	248	111	22
64	916508	70	M	FR	N	N	N	N	N	Y	N	N	N	Y	155	56	23.31	80	18	160	96	4.60	NUA	9.60	3600	96	19	0.70	138	1.80	146	83	45
65	899058	32	M	BS	N	N	N	N	N	N	N	N	N	N	161	65	25.23	88	24	150	100	3.54	NUA	11.00	5800	166	28	1.10	146	1.40	188	62	60
66	897838	58	M	FR	N	N	N	N	N	Y	N	Y	N	N	152	58	25.10	80	20	150	90	4.80	NUA	11.00	8000	180	22	0.70	144	1.80	198	76	58

ANNEXURE IV - MASTER CHART

					Past medical history							Personal history			Examination							Investigations												
Serial Number	In/Out Patient Number	Age (Years)	Sex	Occupation	Renal failure	Gout	Lymphoproliferative disorders	Myeloproliferative disorders	Preganacy induced hypertension	Diabetes mellitus	Thyroid disorders	Smoking	Alcohol consumption	Tobacco chewing	Height (cms)	Weight (Kg)	Body mass index (Kg/m^2)	Pulse rate (/Minute)	Respiratory rate (/Minute)	Systolic blood pressure (mm Hg)	Diastolic blood pressure (mm Hg)	Serum uric acid (mg/dL)	Serum uric acid (mg/dL)	Haemoglobin (gm%)	Total count (/Cumm)	Platelet count (/Cumm)	Serum urea (mg/dL)	Serum Creatinine (mg/dL)	Random blood sugar (mg/dL)	TSH (mcIU/ml)	Total Cholesterol (mg/dL)	Low density lipoprotein (mg/dL)	High density lipoprotein (mg/dL)
67	879032	45	F	HW	N	N	N	N	N	N	N	N	N	N	158	57	22.83	88	18	150	90	6.70	HUA	11.50	4180	180	23	0.90	111	1.60	204	98	35
68	903179	66	M	FR	N	N	N	N	N	N	N	N	N	Y	152	56	24.24	80	22	150	90	6.30	NUA	9.90	3900	95	40	0.60	126	1.40	208	110	21
69	901811	68	M	FR	N	N	N	N	N	Y	N	N	N	N	155	63	26.01	88	20	150	100	7.40	HUA	14.40	3200	99	17	0,6	170	2.80	248	116	13
70	888418	50	F	HW	N	N	N	N	N	N	N	N	N	N	160	55	21.48	80	22	140	90	4.20	NUA	15.00	9950	328	24	1.00	144	2.40	240	150	30
71	889435	62	F	HW	N	N	N	N	N	N	N	N	N	N	159	63	24.72	88	24	158	94	7.40	HUA	13.00	12860	433	24	0.60	174	2.20	236	116	19
72	901857	65	M	FR	N	N	N	N	N	Y	N	N	Y	N	158	53	21.23	88	18	140	90	6.40	NUA	11.00	7700	150	28	0.70	166	2.60	208	94	33
73	900531	42	F	HW	N	N	N	N	N	N	N	N	N	N	161	59	22.76	74	24	130	80	4.60	NUA	10.60	3300	350	36	0.40	128	2.50	118	90	46
74	892352	66	M	SR	N	N	N	N	N	Y	N	N	N	N	156	58	23.83	80	18	180	96	11.20	HUA	9.80	6600	220	24	0.96	144	1.80	256	136	32
75	896295	40	M	FR	N	N	N	N	N	N	N	N	Y	N	158	63	25.08	88	20	150	100	6.70	NUA	10.00	3000	350	16	0.50	126	1.60	240	136	39
76	897595	43	M	SR	N	N	N	N	N	Y	N	Y	N	N	165	63	23.21	70	22	150	90	5.60	NUA	13.00	8800	350	36	0.30	180	1.50	220	130	42
77	901912	40	F	HW	N	N	N	N	N	N	N	N	N	N	159	60	23.54	80	16	150	96	2.50	NUA	11.00	9900	350	36	0.60	144	0.80	180	88	63
78	894311	37	M	SK	N	N	N	N	N	N	N	N	N	Y	162	61	23.05	86	18	140	90	3.55	NUA	12.50	4500	125	20	1.00	122	1.40	198	85	49
79	894564	64	M	FR	N	N	N	N	N	Y	N	N	N	Y	157	65	26.53	70	18	168	90	11.50	HUA	10.60	6500	180	22	1.10	170	1.80	240	110	38
80	4906571	60	M	FR	N	N	N	N	N	Y	N	N	N	N	161	67	25.65	80	22	172	94	8.10	HUA	9.80	10800	250	24	0.98	156	1.20	256	143	14
81	895166	65	M	FR	N	N	N	N	N	N	N	N	N	Y	155	55	23.06	70	20	130	80	6.30	NUA	11.00	12000	225	16	0.80	122	1.00	186	66	59
82	940948	66	F	HW	N	N	N	N	N	N	N	N	Y	Y	158	66	26.44	66	22	160	100	10.90	HUA	11.00	10500	225	18	0.80	166	0.80	246	138	12
83	882591	62	F	HW	N	N	N	N	N	N	N	Y	N	N	159	67	26.30	68	20	166	100	13.50	HUA	12.70	7440	215	48	1.10	146	1.80	216	108	35
84	884505	56	F	HW	N	N	N	N	N	N	N	N	N	N	155	56	23.39	66	20	140	90	6.80	HUA	12.80	8950	248	27	0.70	122	1.60	218	128	30
85	880372	60	F	HW	N	N	N	N	N	N	N	N	N	Y	161	61	23.53	80	24	150	90	6.00	NUA	10.20	12390	114	27	1.10	166	1.00	248	136	19
86	880052	36	F	HW	N	N	N	N	N	N	N	N	N	N	160	57	22.15	70	18	150	94	2.51	NUA	10.60	8650	165	30	0.80	122	0.80	146	78	56
87	903072	62	M	FR	N	N	N	N	N	N	N	N	N	Y	158	55	22.19	80	20	160	100	7.80	HUA	10.00	12590	307	36	0.90	166	2.40	224	134	26
88	899739	71	M	FR	N	N	N	N	N	N	N	Y	Y	N	160	68	26.56	88	18	170	94	8.10	HUA	11.20	5460	192	31	0.90	180	2.60	252	136	31

ANNEXURE IV - MASTER CHART

Serial Number	In/Out Patient Number	Age (Years)	Sex	Occupation	Past medical history							Personal history			Examination							Investigations											
					Renal failure	Gout	Lymphoproliferative disorders	Myeloproliferative disorders	Preganacy induced hypertension	Diabetes mellitus	Thyroid disorders	Smoking	Alcohol consumption	Tobacco chewing	Height (cms)	Weight (Kg)	Body mass index (Kg/m^2)	Pulse rate (/Minute)	Respiratory rate (/Minute)	Systolic blood pressure (mm Hg)	Diastolic blood pressure (mm Hg)	Serum uric acid (mg/dL)	Serum uric acid (mg/dL)	Haemoglobin (gm%)	Total count (/Cumm)	Platelet count (/Cumm)	Serum urea (mg/dL)	Serum Creatinine (mg/dL)	Random blood sugar (mg/dL)	TSH (mcIU/ml)	Total Cholesterol (mg/dL)	Low density lipoprotein (mg/dL)	High density lipoprotein (mg/dL)
89	882890	54	F	HW	N	N	N	N	N	N	N	N	N	N	162	56	21.34	80	16	150	94	2.52	NUA	13.70	7480	211	30	0.80	120	3.20	208	98	41
90	888392	70	F	HW	N	N	N	N	N	Y	N	N	N	N	159	54	21.36	88	24	150	90	4.50	NUA	10.90	18690	186	18	0.80	186	3.00	168	83	41
91	889003	71	F	HW	N	N	N	N	N	Y	N	N	N	N	155	55	22.68	80	22	160	100	8.30	HUA	9.40	10820	319	40	1.00	168	3.80	216	106	38
92	866200	55	F	HW	N	N	N	N	N	N	N	N	N	N	163	66	24.99	88	18	148	94	6.20	NUA	12.20	12700	360	23	0.70	134	1.80	280	139	18
93	854425	61	M	FR	N	N	N	N	N	N	N	N	Y	N	152	59	25.32	70	22	160	90	5.70	NUA	17.00	11890	259	16	1.00	144	1.50	98	58	64
94	854186	65	M	FR	N	N	N	N	N	N	N	N	N	N	153	65	27.94	80	18	156	94	6.40	NUA	12.50	13350	261	24	1.00	122	1.60	260	138	18
95	854168	50	M	SK	N	N	N	N	N	Y	N	N	Y	N	159	56	22.15	90	24	166	96	3.51	NUA	12.70	3600	381	22	0.80	132	1.80	216	102	29
96	853594	35	M	FR	N	N	N	N	N	N	N	N	N	N	164	51	18.96	88	22	150	90	3.50	NUA	12.00	4600	245	24	0.90	138	1.60	90	65	59
97	853083	53	F	HW	N	N	N	N	N	N	N	N	N	N	161	57	21.99	66	18	140	90	3.50	NUA	13.00	5300	156	22	0.60	144	1.40	201	98	30
98	852858	48	M	FR	N	N	N	N	N	Y	N	N	N	N	166	69	25.04	70	20	154	96	5.00	NUA	14.00	5780	222	30	1.00	111	2.50	108	87	44
99	852861	50	M	FR	N	N	N	N	N	N	N	N	N	Y	168	75	26.40	68	22	152	98	4.60	NUA	12.00	6600	146	24	1.00	130	2.00	106	68	64
100	4745309	66	M	SR	N	N	N	N	N	N	N	Y	N	Y	171	78	26.64	70	20	166	98	8.00	HUA	13.00	8800	122	20	0.60	120	2.20	209	108	43

ANNEXURE IV - MASTER CHART

Triglycerides (mg/dL)
120
140
146
130
108
220
156
158
160
144
156
206
188
100
166
106
208
146
148
118
220
216

ANNEXURE IV - MASTER CHART

Triglycerides (mg/dL)
148
206
148
139
158
160
208
160
120
226
218
154
159
109
201
148
156
120
208
219
188
103

ANNEXURE IV - MASTER CHART

Triglycerides (mg/dL)
88
154
140
208
76
234
169
153
152
116
215
219
166
158
211
166
89
231
203
156
122
133

ANNEXURE IV - MASTER CHART

Triglycerides (mg/dL)
144
152
159
201
181
151
116
211
161
153
112
145
129
233
95
216
153
159
198
116
206
210

ANNEXURE IV - MASTER CHART

Triglycerides (mg/dL)
166
88
166
210
101
222
160
84
158
84
72
165

"EVALUATION OF SERUM URIC ACID LEVEL IN PRIMARY HYPERTENSION – A ONE YEAR CROSS SECTIONAL STUDY"

By

REG. NO.: BG0117009

Dissertation

Submitted to the

KAHER, Belagavi, Karnataka

In partial fulfillment

of the requirements for the degree of

DOCTOR OF MEDICINE (M.D)

In

GENERAL MEDICINE

DEPARTMENT OF GENERAL MEDICINE
J. N. MEDICAL COLLEGE, NEHRU NAGAR
BELAGAVI - 590 010

APRIL-2020

Introduction

Objectives

Review of Literature

Methodology

Results

Discussion

Conclusion

Summary

Bibliography

Annexure-I

Annexure-II

Annexure-III