Evaluation of Cardiac Status and Study of Co - Existing Cardiovascular Risk Factors of Isolated Systolic Hypertension in Elderly Population

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Abstract: _Background_: *The incidence of Isolated systolic hypertension (ISH) in has dramatically increased over the last ten years, with overweight and obesity playing a major role. Despite the fact that it's yet unclear if ISH and a higher risk of cardiovascular death (CVD) are related.* _Objectives_: *To study of co - existing cardiovascular risk factors of isolated systolic hypertension in elderly population.* _Methods_: *This was 18 month hospital based cross sectional study conducted by Dept. of Medicine; Dr. KNS Memorial Institute of Medical Science, barabanki. One hundred patients, all 60 years and above were included. Each one of these people had their isolated systolic blood pressure checked. i. e. (SBP > 140 mmHg and DBP < 90 mmHg), first time recognised, who visited to Dr KNS Memorial Institute of Medical Sciences, Barabanki in outpatient and inpatient department. Patient were evaluated clinically, also lipid profile, ECG and 2DECHO was done. For qualitative data analysis Chi square test was applied, and for quantitative data analysis t - test and ANOVA tests was applied for significance. If P value <0.05, it was considered significant.* _Results_: *ISH was associated with dyslipidemia (33%), history of smoking (23%), and other factors. The mean value of SLC and RES score was found signifiacnlty higher in stage 3 ISH as compared to other grade of ISH (P=0.001). In our study LVH by SLC criteria and REC criteria is significantly associated with stage 3 ISH (p<0.05). Advanced stage of ISH was significantly associated with LVH. Among 100 cases 25% cases had ischemia. The occurrence of ischemia was found to be linked with advanced stage of ISH (p=0.001). The average patient weighed 62.53±9.50 kg, stood 161.18±11.91 cm tall, and had a mean body mass index (BMI) of 24.42±5.19 kg/m2. The mean BSA was 1.65±0.15 m². The mean Waist hip ratio was 0.92±0.18. Mean value of BMI (p=0.031) and W/H ratio (p=0.023) was comparatively higher in stage 3 ISH. The most prevalent risk factors for cardiovascular disease, including a high body mass index (35%), a high waist - to - hip ratio (47%), and diabetes (29%), were connected to isolated systolic hypertension.* _Conclusion_: *Individualised systolic hypertension affects most people over the age of 60. Hypertension worsens (reaches a higher stage) as people get older. Most cases of isolated systolic hypertension are associated with obesity, dyslipidemia, diabetes mellitus, and a high waist - to - hip ratio.*

Keywords: Isolated Systolic Hypertension, Cardiovascular Death, ECG, 2D Echo

1. Introduction

Individuals with isolated systolic hypertension (ISH), which is distinguished by hypertensive systolic blood pressure (SBP) but non - hypertensive diastolic blood pressure (DBP), are more likely to be older patients. (1, 2)

The incidence of ISH in young people has dramatically increased over the last ten years, with overweight and obesity playing a major role. (3–5) Despite the fact that it's yet unclear if ISH and a higher risk of CVD in youth are related. (6–10)

Nearly 20% of ISH patients in the Framingham Heart Study had systolic and diastolic hypertension (SDH) or isolated diastolic hypertension (IDH; SBP outside the hypertensive zone but DBP inside it) after ten years of follow - up. (11) Little is known, however, regarding whether ISH outcomes in young people vary with time - related changes in BP categorization. Similarly, there is a lack of information on the dangers of CVD linked to IDH in the young people of today.

A systolic blood pressure (SBP) of 140 mm Hg or higher and a diastolic blood pressure (DBP) of less than 90 mm Hg were

the requirements for the classification "ISH" in the prior research (12). A stage 1 hypertension value was determined as 80 - 89 mm Hg or 130 - 139 mm Hg in accordance with the 2017 ACC/AHA blood pressure guidelines. (13) the new criteria led to a rise in hypertension cases, especially in younger age groups. (14–17) The revised criteria show that the risk of cardiovascular disease events is substantially higher for young persons with stage 1 hypertension compared to those with normal blood pressure. (18–20)

However, it is still unclear whether stage 1 ISH, IDH, and SDH constitute distinct groups of young people with different outcomes. It may be possible to enhance risk stratification for the identification of high - risk patients by categorising young persons with stage 1 hypertension as ISH, IDH, or SDH, if the results differ.

The lack of symptoms in many of these elderly people causes them to go untreated for an extremely lengthy period. Finally, they may eventually show up with permanent end - organ problems. The heart is the most frequently implicated organ when end - organ problems arise. Given our nation's fast expanding population, it is crucial that we learn more about

the causes of isolated systolic hypertension and the damage it can do to the cardiovascular system. Thus, the purpose of this research was to evaluate the cardiovascular health of older individuals with isolated systolic hypertension in order to identify potential risk factors.

Objectives of the Study
To find out Cardiovascular changes in isolated systolic hypertension in elderly.
1) The aim of this research is to examine the effects of isolated systolic hypertension (ISH) on the heart using electrocardiogram (ECG) and echocardiogram (ECHO) scans in individuals over 60.
2) In order to comprehend the connection between cardiac problems and isolated systolic hypertension better.
3) For the purpose of researching whether or not these individuals have any additional cardiovascular risk factors.
4) In order to find out whether there's a connection between the occurrence of cardiac problems and the existence of different co - existing cardiovascular risk factors.

2. Material and Methods

The current cross - sectional study was conducted on patients who visited the Dr KNS Memorial Institute of Medical Sciences, Barabanki's outpatient department and on inpatients who were scheduled to see the medicine OPD.

Study Duration: The research spanned the months of August 2022 through February 2024.

SAMPLE SIZE: One hundred patients, all 60 years and above, made up the sample. Each one of these people had their isolated systolic blood pressure checked. i. e. (SBP > 140 mmHg and DBP < 90 mmHg), first time recognised. Inclusion criteria: 1. Patients above 60 years of age.2. Patients with isolated systolic hypertension Standard tests include 1. Microscopy, albumin in urine, sugar, and complete blood counts (cbcs).2. Blood sugar levels before and after food consumption (FBS, PPBS).3. Glycosylated haemoglobin's potential 4. Serum urea 5. Serum Creatinine 5. Lipid Profile.

CARDIO - VASCULAR SYSTEM EVALUTION: Patients were further evaluated for CVS according to following investigations - 1. ECG 2.2D - ECHOCARDIOGRAPHY. **Sample size:** Minimum 100, Calculated using the formula **Sampling Procedure –** Simple Random Sampling.

Statistical Analysis
The data was input into an Excel spreadsheet and evaluated with SPSS version 23.0. The data was presented visually using charts and tables. To ascertain significance, we used an analysis of variance (ANOVA) and a t - test for quantitative data and a chi - square test for qualitative data. It was deemed significant if the P value was less than 0.05.

3. Results

We included one hundred cases of ISH (Isolated Systolic Hypertension). Stage 1 hypertension affected 39%, stage 2 (28%), and stage 3 (33%) of the participants.
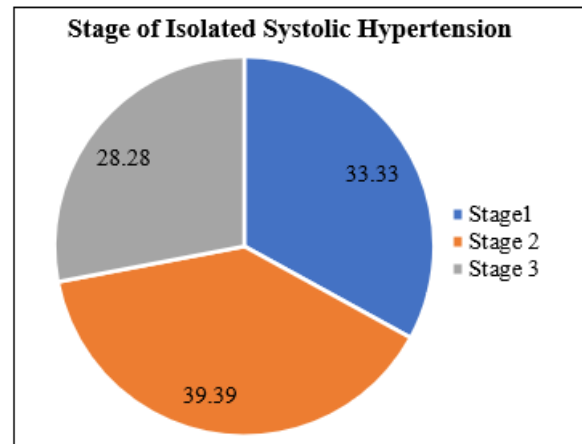

Figure 1: Pie chart showing the distribution as per stage of ISH

The study categorised the severity of hypertension in 100 senior individuals with newly discovered isolated systolic hypertension (≥60yrs) and conducted a cross - sectional analysis. The patients' cardiac health was assessed using echocardiographic and electrocardiographic techniques. An examination was conducted to see whether there were any preexisting risk factors for cardiovascular disease. Near about more then 80% belonged to 66 - 80 years of age. The mean age of patients was significantly higher in stage 3 ISH (P<0.001). In our study; 36% were female and 64% were male. Male preponderance had been noted in our study (M: F=1.78: 1). The gender wise distribution was found comparable in each stage of ISH (p=0.902) ".
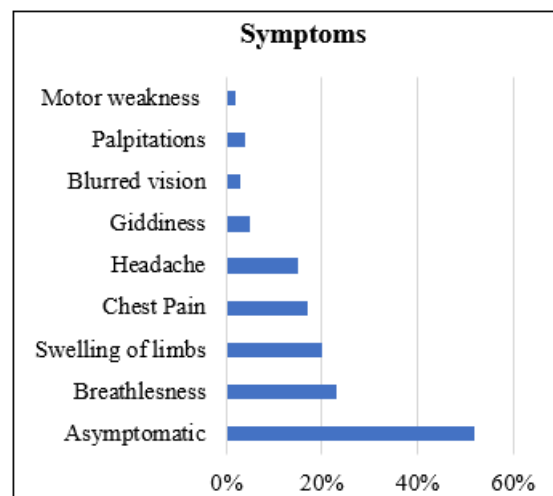

Figure 2: Bar diagram showing various symptoms of ISH

In our study; 52% cases were asymptomatic and 48% had symptoms. In stage 1 ISH had 41% cases symptomatic; in stage 2 ISH - 53.6% symptomatic and in stage 3 - 51.5% symptomatic. But there was no significant difference (p=0.530). There were no symptoms reported by the majority of the older individuals with isolated systolic hypertension in the research. Breathlessness on exercise was the most prevalent symptom noticed in the symptomatic individuals (23%), followed by oedema of the leg (20%) and chest discomfort (17%). Other symptoms like headache; giddiness; blurred vision; palpitation; and Motor weakness were also present.

The average patient weighed 62.53±9.50 kg, stood 161.18±11.91 cm tall, and had a mean body mass index (BMI) of 24.42±5.19 kg/m2. The mean BSA was 1.65±0.15 m^2. The mean Waist hip ratio was 0.92±0.18. Mean value of BMI (p=0.031) and W/H ratio (p=0.023) was comparatively higher in stage 3 ISH. The most prevalent risk factors for cardiovascular disease, including a high body mass index (35%), a high waist - to - hip ratio (47%), and diabetes (29%), were connected to isolated systolic hypertension. Additionally, ISH was associated with dyslipidemia (33%), history of smoking (23%), and other factors. The mean value of SLC and RES score was found signifiacnlty higher in stage 3 ISH as compared to other grade of ISH (P=0.001). In our study LVH by SLC criteria and REC criteria is significantly associated with stage 3 ISH (p<0.05). Advanced stage of ISH was significantly associated with LVH. Among 100 cases 25% cases had ischemia. The occurrence of ischemia was found to be linked with advanced stage of ISH (p=0.001).

Table 1: ECHO characteristics

Stage of HTN		LVIDd	LVPWD	IVSD	LVM	LVMI	LV Vo	EF
Stage 1	Mean	4.55	1.22	1.12	199.31	121.97	63.80	57.79
	SD	0.54	0.24	0.26	69.56	47.78	23.55	6.88
Stage 2	Mean	4.74	1.13	1.06	194.07	116.54	79.97	56.57
	SD	0.50	0.27	0.22	67.72	41.18	19.08	6.60
Stage 3	Mean	4.48	1.28	1.26	230.61	143.64	90.98	46.61
	SD	0.54	0.23	0.31	55.69	36.34	20.60	6.85
Total	Mean	4.58	1.21	1.15	203.22	123.31	74.59	57.06
	SD	0.53	0.25	0.28	64.74	42.39	21.50	6.75
p - value		0.145	0.073	0.012	0.001	0.001	0.001	0.001

Thers is a significant difference in ECHO parameters like IVSD; LVM; LVMI; LV Vol; are increased in stage 3 but EF was significantly lower in stage 3 ISH (p=0.001). The most prevalent echocardiographic finding in ISH patients was an elevated LVMI. Improved LVMI was seen in about 47% of the research participants. Among the instances that were seen, 17% had an increased LV volume, 31% had a decreased ejection percentage, and 29% showed regional wall motion abnormalities.

Table 2: Correlation b/w ECHO changes of LVH and Stage of ISH

ECHO Characteristics	Stages of Hypertension				p - vlaue
	Stage 1	Stage 2	Stage 3	Total	
Increased LVMI	7 (14.8%)	17 (36.1%)	23 (48.9%)	47 (100%)	0.001
Increased LV volume (>90ml/m2)	0 (0.00%)	6 (35.3%)	11 (64.7%)	17 (100%)	<0.001
Reduced ejection fraction (<56%)	0 (0.00%)	6 (19.4%)	27 (80.6%)	31 (100%)	<0.001
Regional wall motion abnormality	0 (0.00%)	2 (6.90%)	27 (93.1%)	29 (100%)	<0.001

There was a significant association between the advanced stage of ISH and echocardiographic features such as an increased left ventricular mass index (LVMI), an increased left ventricular volume (LVV), a lower ejection percentage, and regional wall abnormalities (p<0.05). When compared to echo LVH, the diagnostic value of SLC and RES criteria for ECG diagnosis of LVH is poor, according to statistical analyses of the data shown above. Despite this, the criteria perform better when it comes to specificity (75% vs.85%). In contrast to SLC, RES achieves higher accuracy and a higher kappa coefficient of agreement.

4. Discussion

Hypertension affects more than 50% of the population over 60. In this age bracket, isolated systolic hypertension affects most people. The organising committee of the hypertension education project found that systolic blood pressure is a strong predictor of all cardiovascular events and all causes of death and suffering in an older adult research. The joint national committee on prevention, detection, evaluation, and treatment of hypertension states that in persons over 50, a systolic blood pressure (BP) of more over 140 mm Hg greatly raises the risk of cardiovascular disease. Studies have shown that systolic blood pressure is more strongly associated with right ventricular hypertrophy and that cardiovascular remodelling is more pronounced in ISH than in diastolic hypertension.

The aim of this research is to use electrocardiogram (ECG) and echocardiogram (ECHO) to identify cardiovascular issues in older adults with isolated systolic hypertension, such as lower ejection fraction, left ventricular hypertrophy, and regional wall anomalies. The following is a discussion of our study's primary findings:

Age & Sex Distribution:
A total of 100 elderly (>60years) patients with newly detected isolated systolic hypertension were selected for our study. Mean age of 100 patients was 73.2± 6.51. male to female ratio 1.78: 1. Out of this male constituted 64% and 36% were females. However, this difference in incidence between makes and females was not found to be significant (p=0.0902). The results of Dwivedi et al. (2000), which showed a male to female ratio of 1.44: 1 and an average age of 67.36±6.23 years, are not found in this one. The average age of the participants in the Systolic Hypertension in Elderly People (SHEP) study was 72 years old, with a mean blood pressure measurement of 170/77 mm Hg. Michael A. Colandrea et al. found that the average age was 69.7 years (21). (22) The proportion of hypertensives with ISH increases with patient age (those above 70), according to studies by Thomas Kuruvilla et al. (23) A total of ISH was seen in 82.1% of female hypertension patients and 75.6% of male patients. Females were more likely to have ISH than males. (23)

Correlation of age with stage of hypertension
All patients with stage 1 BP had an average age of 69.56±3.42 years in this research. It was 73.07±4.56 years for Stage 2 patients and 71.27±5.93 years for Stage 3 BP. The age group of 66–80 years comprised about 80% of the sample. Statistical analysis revealed a substantial association (p < 0.001) between age and the severity (stage) of blood pressure, as evidenced by the data presented above.

Nesserli FH et al. 's results indicate that the prevalence of ISH increases with age. It ranges from around 5% to 25% in people over the age of 60. (24) According to Rocha et al., the 60 - 80 age group has shown a 44 - 57% increase in the prevalence of ISH. (25) A third of the population over 60 suffers from this kind of hypertension. The likelihood of developing systolic hypertension is much lower in younger

persons. There is an estimated 1.8% prevalence among those aged 18–39 and 6% among those aged 40–50. (26)

Symptomatology
A total of 52% of individuals in this trial did not experience any symptoms. Breathlessness during exercise was the most often noted symptom among the patients exhibiting symptoms (23%). Chest pain (17%) and edoema of both legs (20%) were other prevalent complaints. Stage 3 ISH patients made up the majority of the patients experiencing symptoms. According to the study conducted by Vrinda et al., 32% of the patients experienced symptoms. Of those symptoms, headaches were the most common presenting symptom at 79.95%. Nevertheless, participants in this study were between the ages of 60 and 65. (27)

Risk Factors Associated with Ish:
BMI > 25 was present in 35% of the individuals. In men, 47% of patients had a waist - to - hip ratio more than 0.9, whereas in females, it was 0.8. Diabetic complications affected 29% of patients.

According to Dwivedi S et al., diabetes mellitus was identified in 31.41 percent of patients. N. C. Hazarika et al. (28) found that age, body mass index (BMI), and the waist - hip ratio were significant risk variables associated with obesity. Conversely, the health benefits of smoking are inversely related to it. Dyslipidemia was seen in 56.3% of survey respondents. The prevalence of dyslipidemia was 46.8% in the P. Malhotra et al. research.23.7% of people had isolated high HDLC, while 18.8% of people had elevated triglycerides. All age groups with hypertension were included in the research. (29)

Electrocardiographic Changes:
The present investigation found left ventricular hypertrophy to be the most prevalent ECG abnormality. About 37% of patients tested positive for Sokolow - Lyon, and the same percentage tested positive for Romhilt - Esteees. It was found in 29% of individuals. According to Vrinda et al. (2018), the majority of patients (36.6%) had LVH as their most prevalent ECG abnormality. Boon D et al. (30) reported that silent myocardial ischemia is prevalent in ISH (27)

Echocardiographic Changes
A greater left ventricular mass index was found in 47 percent of individuals among the anomalies found on echocardiograms in this investigation. In 17% of cases, the left ventricle grows in size. Lower ejection fractions were seen in 31% of patients. A total of 29% of patients had irregularities in regional wall motion.

Over half of the patients had an elevated left ventricular mass index, making it the most prevalent anomaly. The general population was also reported to have echocardiographic evidence of left ventricular hypertrophy by Lindross M et al. (31)

Association of Stage of Blood Pressure with Increased LVMI:
In this investigation, we found that the LVMI was elevated in 14.8% of individuals with stage 1 BP. Elevated LVMI was seen in individuals in stages 2 (36.1%) and 3 (48.1%). Data analysis revealed a statistically significant (p = 0.001) correlation between the occurrence of increased LVMI and the degree (stage) of hypertension.

The Sensitivity and Specificity of ECG LVH vs Echo LVH
The ECHO scan is still regarded as the gold standard for diagnosing LVH since it is more accurate than the Sokolow - Lyon and Romhilt - Estees criteria for ECG LVH.

Both the sensitivity and specificity of SLC were 49.53% and 75.20%, respectively, in this investigation. In contrast, the RES criteria have an accuracy rate of 88.84% and a sensitivity of 45.24 percent. In contrast to SLC, RES achieves higher accuracy and a higher kappa coefficient of agreement.

This study's findings provide credence to the idea that electrocardiogram (ECG) criteria have a poor relative sensitivity and that there is only a modest correlation between Sokolow - Lyon and LVH.

Reichek et al. showed that LVH estimated by echocardiography is very sensitive and has a strong correlation (r=0.96) with LV - weight measured after death. thus, echo LVH outperforms current ECG techniques and is very dependable. (32)

The small sample size may explain why the ECG criteria were less sensitive and specific in this study compared to others. The sample size does not reflect the population being studied. Also, as a tertiary referral center, we see the most severe cases of LVH, so it's possible that this is a result of selection bias. Factors external to the body, such as obesity, emphysema (smoking), IHD, and female sex (breast tissue), affect the voltage and decrease sensitivity, according to studies. It is important to remember technical details like where to put the electrodes and how to interpret the results.

One possible explanation for low specificity could be an increase in false positive cases. Despite a typical left ventricular mass, the false positive could be caused by external factors such as cachexia or enlarged hearts.

Therefore, electrocardiogram (ECG) computer analysis is necessary to enhance the early stage diagnostic accuracy of ECG criteria. In order to diagnose LVH quickly and accurately, more sensitive ECG criteria are also required. It is recommended that clinicians stick with the ECG criteria (SLC, RES) that have a better track record of detecting LVH. In clinical patient populations where a specificity of 95% is considered acceptable, these criteria should be applied.

5. Conclusion

- Individualised systolic hypertension affects most people over the age of 60. Hypertension worsens (reaches a higher stage) as people get older.
- Most cases of isolated systolic hypertension are associated with obesity, dyslipidemia, diabetes mellitus, and a high waist - to - hip ratio.
- There are no symptoms experienced by most people. Nevertheless, the heart is the primary target of ISH - related risk factors, particularly with regard to left ventricular hypertrophy. When contrasted with diastolic

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blood pressure, it is a better indicator of mortality and disease.

- It was also demonstrated that an increased left ventricular mass index is more likely to occur in patients with hypertension. Several large - scale trials have demonstrated the efficacy of treating ISH. Patients benefit greatly from even modest drops in blood pressure.
- Early detection and prompt treatment of ISH in the elderly are crucial for preventing or reducing cardiovascular morbidity and mortality in our rapidly aging society.

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