Solovyov Studies ISPU | ISSN: 2076-9210

Profiling Hypertension Characteristics Among Individuals Affected by Stroke

Jeena R S

Department of ECE, Govt Engineering College, Barton Hill, Kerala Technological University

***Abstract*—** Hypertension, also known as high blood pressure, stands as a significant contributor to cerebrovascular ailments such as stroke. The prolonged impact of elevated blood pressure leads to the deterioration of arterial walls, rendering them susceptible to thickening, constriction, or even rupture. Mitigating these risks can be achieved by managing blood pressure through lifestyle adjustments and medication. To delve deeper into this relationship, a study has been undertaken involving a cohort of stroke patients to examine their blood pressure profiles. The primary objective of this study is to investigate the influence of systolic and diastolic blood pressure levels in stroke patients, along with their fluctuations during follow-up periods.

***Keywords*—** **Stroke, Hypertension, Systolic Blood pressure, Diastolic Blood Pressure**

I. INTRODUCTION

Stroke stands as the most prevalent life-threatening cerebrovascular affliction in many developing nations. Extensive research has highlighted the pivotal role played by hypertension in the occurrence of stroke. Hypertension has earned the moniker of the 'silent killer' due to its often-asymptomatic nature, allowing individuals to harbor this condition unknowingly. Blood pressure, or hypertension, is defined as the force exerted by blood against the vessel walls and is measured in millimeters of mercury. Hypertension is diagnosed when systolic blood pressure (SBP) equals or exceeds 140 mm Hg and/or diastolic blood pressure (DBP) equals or exceeds 90 mm Hg. Maintaining normal levels of both systolic and diastolic blood pressure is essential for the proper functioning of vital organs such as the heart, brain, and kidneys [1]. In India, hypertension directly contributes to 57% of stroke-related deaths and 24% of coronary heart disease cases ([2]-[3]). Research into hypertension prevalence in India reveals that 33% of urban and 25% of rural Indians suffer from hypertension [4]. Early detection and effective control of hypertension can significantly reduce the risk of heart failure, heart attack, stroke, and kidney failure.

Blood vessels are designed to withstand a certain level of internal pressure and can tolerate short-term pressure increases with minimal harm. However, sustained high pressure within the blood vessels weakens them over time. The continuous strain on the vessel walls weakens their muscular structure, eventually leading to persistent narrowing of the blood vessels—a condition known as atherosclerosis. When these blood vessels become weakened and narrowed, the risk of an aneurysm, which can rupture and result in a hemorrhagic stroke, significantly increases [5].

High blood pressure places a substantial burden on the heart, forcing it to work harder to maintain blood circulation. Prolonged overexertion can lead to damage to the heart muscle, ultimately causing heart disease and heart failure. It may also result in irregular heart rhythms, such as atrial fibrillation, where the upper chambers of the heart quiver instead of contracting properly. This can impede blood flow from the atria to the ventricles, potentially leading to blood clot formation. These clots increase the risk of an ischemic stroke ([6]-[8]).

The American Heart Association defines blood pressure categories as follows:

Normal Blood Pressure: Systolic < 120 mm Hg; Diastolic < 80 mm Hg
Elevated Blood Pressure: 120 mm Hg < Systolic < 129 mm Hg; Diastolic < 80 mm Hg
Stage 1 High Blood Pressure: 130 mm Hg < Systolic < 139 mm Hg or 80 mm Hg < Diastolic < 89 mm Hg
Stage 2 High Blood Pressure: Systolic > 140 mm Hg or Diastolic > 90 mm Hg

Details of the study conducted has been elaborated upon in the next section.

II. SUBJECTS AND METHODS

A retrospective cross-sectional study was conducted to investigate the hypertension profiles of stroke patients. Blood pressure data were collected by reviewing the records of 500 stroke patients admitted to Sree Gokulam Medical College and Research Foundation in Kerala over a period of 6 months. The study population included individuals aged between 46 and 78 years, comprising both males and females. Trained physicians measured systolic and diastolic blood pressures in the right arm using standard mercury sphygmomanometers equipped with a cuff measuring 14 cm in width and 51 cm in length, following unified epidemiological methods. The study was conducted in strict adherence to the guidelines provided by the Ethical Committee. Informed consent was obtained from all subjects who were considered for participation in this study. It is important to note that the information obtained was treated as confidential and used exclusively for the purposes of this research.

III.RESULTS AND DISCUSSION

Blood pressure was measured in subjects at each examination, together with other clinical risk factors. Initial cases of stroke and transient ischemic attack were obtained from recorded hospital data. A follow up has been done after each month. Analysis of the data shows that men are more prone to stroke than women. Of the total stroke reported cases, 73 % were men while women constitute only 27 % with a male to female ratio of 2.1:1. The ages ranged from 46 years to 78 years with a mean of 68.2 ± 10.2. Figure 1 shows the Age - frequency plot of the real time data.

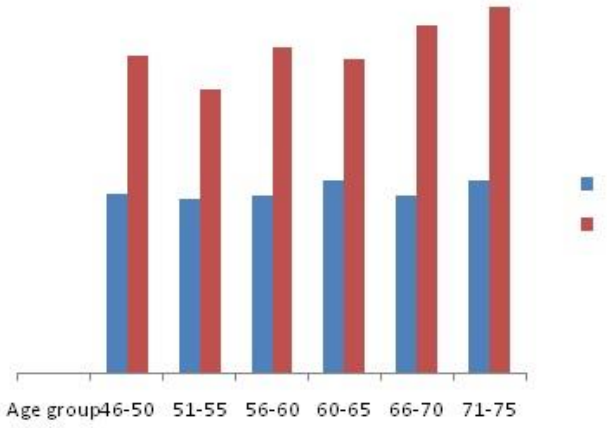

Fig.1 Age Frequency Plot

Systolic Blood pressure on admission was 156 ± 29.8 mmHg and Diastolic blood Pressure on admission was 90.4 ± 15.6 mmHg. Figure 2(a) and (b) shows the variation in mean SBP and mean DBP for female and male respectively.

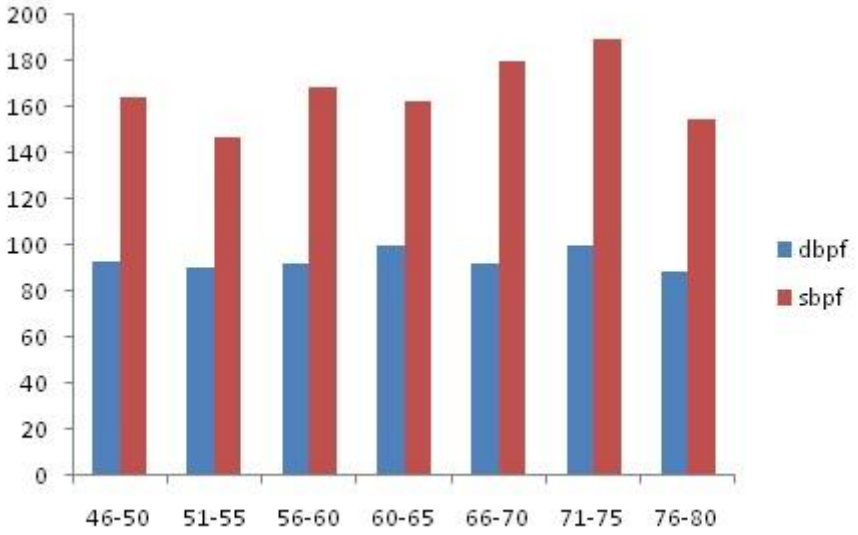

Fig. 2(a) Variation in SBP and DBP for female

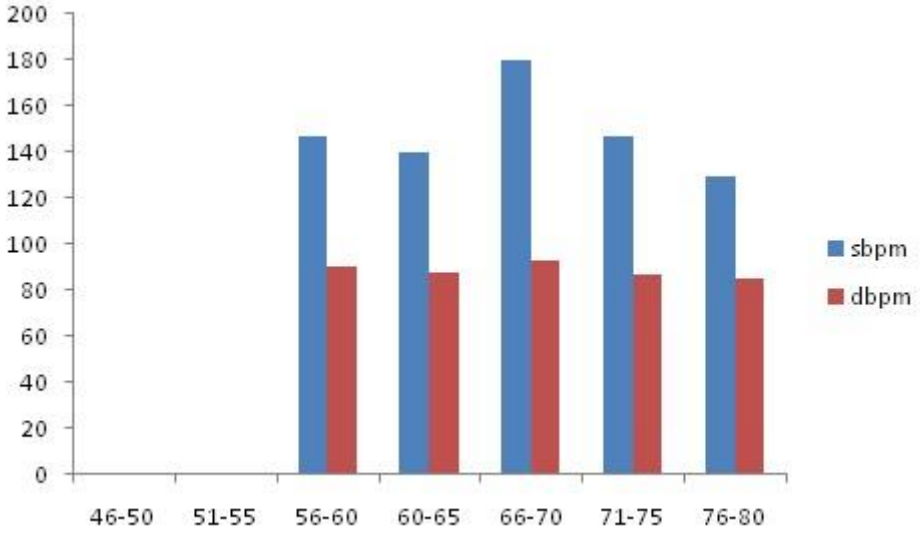

Fig. 2(b) Variation in SBP and DBP for male

Proper management of blood pressure (BP) in stroke cases may improve the outcome ([9]-[10]). The relation between the change in BP after acute stroke and outcome has been studied by several investigators and are recorded in literature ([14]-[15]). In most cases, antihypertensive agents were used to lower the blood pressure and so it was difficult to isolate the effect of the drug from the effect of spontaneous BP variation. Here, the association between various BP variables in the acute phase of stroke and functional outcome at every month for a period of 8 months has been analysed ([11]-[13]).

Recurrent stroke has been reported in 5 % of the male patients. It was found that SBP / DBP increased from baseline by 16/20 mm Hg and were associated with an increased risk of stroke. Average decrease in blood pressure was noted to be 30 / 10 mm Hg. The variations in mean blood pressure [12] for 8 months starting from the time of admission have been analysed.

The effect of both SBP and DBP has been examined by including it in a stepwise regression model. In this work, logistic regression has been implemented for the analysis of SBP and DBP and Medcalc has been used as the statistical computation tool. The standard value chosen for level of significance is 5 %. Risk factors with $p < 0.05$ in were used to set up the stroke risk assessment model. If $p < 0.05$, null hypothesis can be rejected and the risk factor can be included in the model. Analysis shows that both DBP and SBP gave p value < 0.05 and hence it can be concluded that both are stronger predictors of stroke.

IV. Conclusions

This study vividly illustrates the heightened risk of stroke associated with elevated blood pressure levels. The prevalence of hypertension observed in this investigation was notably higher among males than females. The real-time data analysis conducted in this study concludes that both systolic blood pressure and diastolic blood pressure emerges as robust predictors of stroke. Consequently, the continuous monitoring of blood pressure is imperative for stroke prognosis and has important implications for optimizing blood pressure management. This includes determining an appropriate blood pressure target and ensuring its stability.

Acknowledgment

I would like to acknowledge the staff of Sree Gokulam Medical College and Research foundation for providing me the necessary support in providing the data for my work.

References

[1] World Health Organization Report, A Global Brief on Hypertension, WHO, 2013.
[2] R. Gupta, “Trends in hypertension epidemiology in India,” Journal of Human Hypertension, vol. 18, no. 2, pp. 73–78, 2004.
[3]R. Gupta and V. P. Gupta, “Hypertension epidemiology in India: lessons from Jaipur heart watch,” Current Science, vol. 97, no. 3, pp. 349–355, 2009.
[4]R. Anchala, N. K. Kannuri, H. Pant et al., “Hypertension in India: a systematic review and meta-analysis of prevalence, awareness, and control of hypertension,” Journal of Hypertension, vol. 32, no. 6, pp. 1170–1177, 2014.
[5] Mattle HP, Kappeler L, Arnold M, Fischer U, Nedeltchev K, Remonda L, Jakob SM, Schroth G. Blood pressure and vessel recanalization in the first hours after ischemic stroke. Stroke. 2005;36:264 –268
[6] Warlow C, Sudlow C, Dennis M, Wardlaw J, Sandercock P: Stroke. *Lancet* 362: 1211 –1224, 2003
[7]Lawes CM, Bennett DA, Feigin VL, Rodgers A: Blood pressure and stroke: An overview of published reviews. *Stroke* **35** : 1024 –1033, 2004.
[8]Lawes CM, Rodgers A, Bennett DA, Parag V, Suh I, Ueshima H, MacMahon S: Blood pressure and cardiovascular disease in the Asia Pacific region. *J Hypertension***21** : 707 –716, 2003.
[9]Dawson SL, Manktelow BN, Robinson TG, Panerai RB, Potter JF. Which parameters of beat-to-beat blood pressure and variability best predict early outcome after acute ischemic stroke? Stroke. 2000;31:463–8.
[10]Yong M, Diener HC, Kaste M, Mau J. Characteristics of blood pressure profiles as predictors of long-term outcome after acute ischemic stroke. Stroke. 2005;36:2619–25.[PubMed]
[11]Morfis L, Schwartz RS, Poulos R, Howes LG. Blood pressure changes in acute cerebral infarction and hemorrhage. Stroke. 1997;28:1401–5. [PubMed]
[12] Wallace JD, Levy LL. Blood pressure after stroke. JAMA. 1981;246:2177–80.[PubMed]