

## Comprehending hypertension by 'comprehensive rules of thirds and halves'

Nidhi Dinesh Sinha<sup>1</sup>, Badrinarayan Mishra<sup>2\*</sup>, S C Mohapatra<sup>3</sup>

<sup>1</sup>Associate Professor & HOD, <sup>2</sup>Professor, <sup>3</sup>Professor & Head, <sup>1</sup>Dept. of Dentistry, <sup>2,3</sup>Dept. of Community Medicine, R. D. Gardi Medical College, Ujjain, Madhya Pradesh, <sup>3</sup>SGT University, Gurgaon, Delhi/NCR, India

**\*Corresponding Author:**

Email: badrinmishra@gmail.com

### Abstract

Essential or primary hypertension has grown demonic, no country or commune is immune to it. Lot has been revealed and said about this silent killer, what lacks is committed action. A righteous approach to detect, educate and treat is the need of the hour. Present article discusses common and preventable issues concerned with its misdiagnosis poor awareness and missed opportunities.

**Keywords:** Hypertension, Misdiagnosis, Missed Diagnosis, Rules of Thirds and Halves.

### Hypertension

Hypertension (HTN), a disease of eternity, is presently a devastating disease with thumping global presence. The trio of hypertension (primary or essential), obesity and type 2 diabetes ('HOD complex' as 'we' prefer to call them) rule the disease world; in term of number of patients, complications and deaths. This trio; once symbolized as 'diseases of affluence' had and will undergo many demographic and epidemiological transitions in tandem with socio-cultural and economic revolution; abiding by the 'law of nature'.

The marks of evidence are overtly evident on this disease. There was a time when increased blood pressure was considered a normal physiological adaptation of the body, which still is; but deliberate alteration was warned to have testing consequences.<sup>(1,2)</sup> The case of American President Mr. Franklin Delano Roosevelt was a classic example of consequences of untreated HTN and an eye opener for future research.<sup>(3)</sup> Afterwards on comprehension of the deleterious effect of sustained high blood pressure (BP), restriction and control of BP level was advocated. The available literature points to the first hypertension treatment guideline; which promoted BP restriction for a level above 200/100 mm Hg when associated with symptoms or complications.<sup>(4-6)</sup> Since then diagnosis and treatment of hypertension has undergone a sea of change.

### Measuring blood pressure

Measurement of blood pressure is the most common clinical procedure and should customarily be done on every possible interaction with a patient. This will not only enlarge the scope of detection but also encourage millions to seek treatment. Though the intent sounds noble, solemnity is lacking. Despite pioneering research, thousands of excellent publications and benchmark guide lines; screening, diagnosis and management of this dreaded disease are subject to perpetual neglect.<sup>(7-14)</sup> There is 'agony in adherence' at

all levels; be it the physician, patient or the policy makers. This has lead to 'dilemma in diagnosis'.

Sources have affirmed that 1/3<sup>rd</sup> of world's adult population is hypertensive.<sup>(15,16)</sup> But, unfortunately their detection is at the mercy of health professionals and policy makers. Chronic apathy at these levels has pushed HTN detection to an unsafe corner, to a diagnostic impasse. These 'diagnostic dilemmas' may be concised in to 3 broad categories of equal proportion and significance which we coin as "Mishra and Sinha's rule of thirds". This rule states, "1/3<sup>rd</sup> of world's adult population is hypertensive, of which, 1/3<sup>rd</sup> are diagnosed, 1/3<sup>rd</sup> misdiagnosed and 1/3<sup>rd</sup> undiagnosed". Let us dig it little deeper.

Dilemma 1: Contrary to concurrent and common belief evidences suggest that only 1/3<sup>rd</sup> of HTN are correctly diagnosed.<sup>(17,18)</sup> Disease awareness and treatment adherence at global level still languish at Wilber and Barrow 'rule of halve'.<sup>(7-14)</sup>

Dilemma 2: Pulled research evidence suggests that 1/3<sup>rd</sup> cases of HTN are 'misdiagnosed'.<sup>(17-24)</sup> The fallacy in diagnosis squarely rests on errors committed by documenting professionals and the equipment employed which emulates 'Mishra and Sinha rule of halve for misdiagnosed HTN'.

Dilemma 3: This emphasizes on the remaining 1/3<sup>rd</sup> HTN cases those 'miss the chance of getting diagnosed' due to professional apathy by physicians and policy makers alike; and highlighted here through 'Mishra and Sinha rule of halve for undiagnosed HTN'. These dilemmas are depicted in Fig. 1.

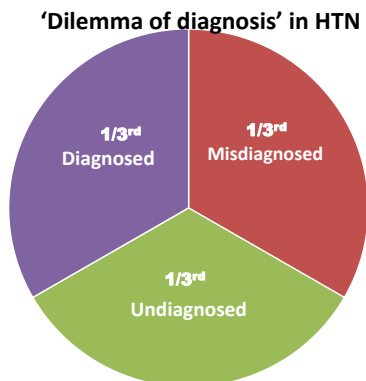


Fig. 1

Let us fit these dilemmas to appropriate adherence problems and suggest rules and methods for its amelioration.

**Dilemma One:** This deals with correct diagnosis and patient adherence to treatment. When Wilber and Barrow popularised the first 'rule of halve' for HTN in mid 1970, their focus was to 'highlight the issue of under diagnosis and public unawareness.'<sup>(6,8)</sup> Since then the scenario has improved mostly in industrialized and developed nations. For many of them this first rule of halve has bettered to rule of 2/3<sup>rd</sup>, where that many cases are said to be diagnosed.<sup>(18)</sup> But the question is - 'Are all these 2/3<sup>rd</sup> cases correctly diagnosed'? Closer looks at the diagnosis technicalities will leave you open mouthed! The health care professionals are observed to er on multiple domains and the equipments used act as compounders to it.<sup>(25-27)</sup> This flaw in diagnosis has given birth to the 2<sup>nd</sup> dilemma.

**Dilemma Two:** Reports demonstrate that 1/3<sup>rd</sup> cases of HTN are misdiagnosed.<sup>(12-20)</sup> The agents for misdiagnosis are the 'man and the machine'. Both these components are matters of serious concern. Man induced errors are many, where health care professions and the patients are party to it in equal aplomb. Equipment induced errors are also not a lesser player; whether it is a conventional standing mercury manometer or an automated digital one. 'Mishra and Sinha rule of halve' the second one for HTN; tries to draw attention to these potentially preventable issues.

**Dilemma Three:** There is a staggering 1/3<sup>rd</sup> proportion of HTNs which remains undiagnosed.<sup>(13,28,29)</sup> Professional and policy makers apathy are its root cause. 'Unwillingness more often than unawareness' at cashing on all available opportunities to record BP at professional level and virtually nonexistent health policy that promises at least one methodologically accurate BP recording to it population should squarely be blame for this poor state of affair. The third rule of halve for HTN as proposed by us 'Mishra and Sinha' here highlights this area.

Thus, the problem of HTN can best be comprehend by 3 major challenges that can be summed up under 3 rules of halve.

1. The first rule of halve propagated by Wilber and Barrow highlights the issue of disease detection, awareness and adherence to treatment.
2. The second rule of halve proposed in this article by 'Mishra and Sinha'; lay emphasis on misdiagnosis of HTN and its subsequent unwanted treatment.
3. The third rule of halve also proposed her by 'Mishra and Sinha' reflects apprehensions on undiagnosed hypertension and ways to improve them. (Fig. 2.)

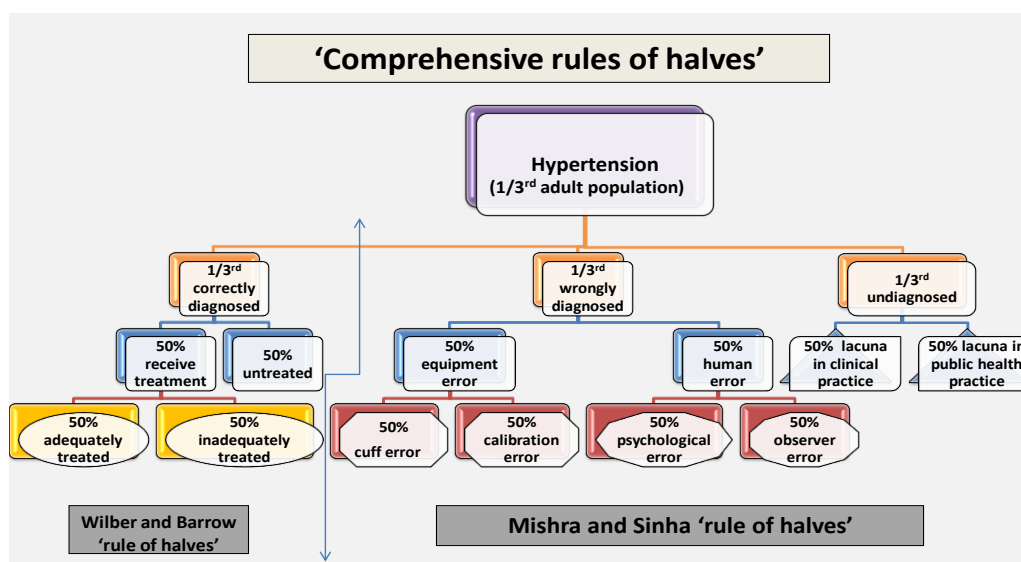


Fig. 2

**Wilber and Barrow 'rule of halves of awareness and management' of hypertension:** Coining the slogan "rule of halves" in human hypertension by Wilber and Barrow was a competent step in right direction. This evidence based rule popularized in 1970s and 1980s had brilliantly summarized apathy towards this dreaded disease. It states "only half of hypertensive are detected, half of which are treated, of which only half achieves adequate BP control" thus highlighting the concern for neglect.<sup>(9)</sup> As an after match in subsequent 4 decades the detection and treatment adherence rate has increased more so in the developed and industrialized world. Many Scandinavian countries have improved this to "the rule of 2/3<sup>rd</sup>" where over 66% of cases are detected and increasing numbers are adherent to satisfactory treatment guide lines.<sup>(18)</sup> But at global level a lot is desired to be done, especially with respect to accurate diagnosis. While we are still battling out at enhancing detection and outcome of HTN we cannot be lax in its diagnosis. The literature supported prevalence of misdiagnosed HTN is at a disturbing 50% level.<sup>(8,30,31)</sup>

**Mishra and Sinha's 'rule of halve for misdiagnosis' of hypertension:** Let us state the rule first. It says that out of all those diagnosed as hypertensives, 50% are correctly diagnosed and 50% wrongly (1<sup>st</sup> rule). Of those who are wrongly diagnosed; 50% are because of equipment error and 50% due to human error (2<sup>nd</sup> rule). Further sub grouping shows, 50% of equipment errors are due to cuff mismatching and the remaining 50% as consequence of mercury manometer column deficit and lack of standardization (3<sup>rd</sup> rule). Of the human components leading to fallacious BP recording; 50% are psychological (patient related) and the other 50% observer induced (4<sup>th</sup> rule).

We are walking a thin line with respect to measurement of BP and diagnosis of HTN. It is estimated that 43 million people in U.S. are hypertensive. A departure or sway of 5mm of Hg in measurement on either way can lead to an under estimation by 20 million or over estimation by 23 million cases.<sup>(30)</sup> We have similar statistics from other part of the world.<sup>(9,10,17,23)</sup> As of now a margin of error by  $\pm 5$ mm Hg is in common place in indirect PB measurement across all types of equipments and observers.<sup>(32-40)</sup> This lends support to our observation that while 50% of HTN are correctly diagnosed the other 50% are wrongly diagnosed (the first rule).

Error in blood pressure measurement is inherent to the complexity of the equipment and diversity of human perception. These two issues can lead to either under or over estimation of blood pressure and consequent misdiagnosis. Analysis of research findings does show that these two major bifurcates are also equally responsible in errant diagnosis, thereby providing evidence for the second rule.<sup>(21 24,28,36)</sup>

**Equipment Errors:** Standing mercury sphygmomanometer is considered as the gold standard equipment to measure indirect blood pressure in human. Unfortunately the fear of mercury spillage and consequent health risk is slowly and steadily getting this excellent equipment replaced. But the irony is that the replacements instead of being superior and a class of its own find solace in their age old and phasing out competitor.

Mercury sphygmomanometer is the standardizing device for its young rivals like aneroid sphygmomanometers and oscillatory devices. Any defect that is intrinsic to the standardizing device will logically express in the evaluated products. As a result these newer generation equipments are found to be less accurate.<sup>(28-36)</sup>

When we talk about the equipment fallacies responsible for erroneous blood pressure recording, two things come vividly to our mind. They are miscuffing and deficient mercury manometer height. These apart there are other issues, the prominent one being lack of regular equipment standardization.

Let us consider arm cuff first. Irrespective of the type of equipment i.e. mercury column manometer, aneroid manometer or oscillatory devices; a feature constant to all is the use of arm cuff. Misuse of arm cuff and its corollary on blood pressure recording is being well documented and quantified. A mismatched arm cuff leading to clinic-statistical significant deviation in blood pressure recording at a range of  $\pm 5$ mm of Hg is a regular affair.<sup>(32-38)</sup> Even fluctuations in the range of 'as low as 7mm Hg to as high as 20mm Hg' is in common place.<sup>(28 29)</sup>

Manometer deficit is perhaps reported first time by Mishra et al. In their path breaking study titled "Equipment errors a prevalent cause for fallacy in PB recording --"; where it was observed that standing mercury manometer height was short (deficient) by 12mm on most occasions.<sup>(20)</sup> This deficit works out to 4mm on conversion to a scale of 100 (which is the average blood pressure in normal adults i.e.  $120+80/2=100$ ), an over estimation of 4mm Hg in all cases - A pretty serious issue?

We know that all equipments must be subjected to regular standard checks and quality assurance. But how many of us do really care? In developing countries most physicians look at the sphygmomanometer as one time investment. Regular quality check is a naive concept. Studies have shown that ill maintained devices can affect BP recording by a range of - 5mm Hg to + 12 mm Hg.<sup>(25,27-35)</sup>

**Human Error:** 'To err is human' but to learn from them is 'being human'. On contrary we are more careless and casual, especially on a sensitive subject like BP recording. There is plethora of evidence of different human factors that lead to fallacious BP recording. Be it white coat HTN or trainee induced

HTN, which touches patients psychology, or incorrect patient and/or equipment positioning by the observer; both have their deleterious consequences. To add salt to the injury we have issues of rounding of, a routine practice even by the most seasoned physicians.<sup>(32-35,38)</sup> Lacks of concern to patient rest time, food and medication history are the other compounders.

**Mishra and Sinha's 'rule of halve for undiagnosed HTN':** This rule states that of the total undiagnosed cases, 50% are due to 'callousness in present clinical practice' and 50% due to 'apathetic public health practice'.

A closer look at existing clinical practice makes it evident that ample opportunities are lost on BP recording, on routine 24X7 bases. A customary visit to a clinician's chamber most often goes unexplored. BP is not routinely recorded unless the patient presents with complains or the physician requires to conform or rule out HTN. Even many clinical departments don't ask for a BP reading for their inpatients! These are huge loss of opportunity. If enchased upon they can improve detection of veiled (undiagnosed) hypertension by 50%.<sup>(38-40)</sup>

On present day more than 70% of overall mortality relates to NCD (non communicable diseases) and almost 40% can be linked to HTN. A proactive public health approach in terms of annual screening at grass root level ensuring at least one methodologically correct BP recording for individuals over 18yrs/yr can go a long way in finding the other occult halve.<sup>(39-41)</sup> It is being aptly suggested that measurement of blood pressure be a part of national health surveys.<sup>(40)</sup>

### Summary

The objective of this write up is to draw attention of medical commune to difficulties allied to detection of hypertension. Most of these are avoidable and need little vigilance and sincerity to overcome this hurdle.

The first rule of halve proposed by Wilber and Barrow is doing its job and will continue to do so. Now is the turn for the other rules of halves to get noticed and work at the interest of the populace. At a time of scientific marvel we must be sceptical about misdiagnosis and consequences of unwarranted medication. It is also our prime duty to act sensibly and discharge our social and academic obligation by which the detection rate of undiagnosed HTN can improve.

The policy makers must ensure enrichment of quality data base and compel the equipment manufacturers to produce quality products and adopt smart packaging there by making equipment subcomponents like different arm bladder cuffs universally available.

### Conclusion

It has become apparent that there are two major barriers to efficient HTN detection and management.

The first one is 'public apathy' and the second one is 'professional apathy' i.e. physician, policy maker and equipment manufacturers' apathy.

Wilber and Barrow 'rule of halves' highlights gross public unawareness about the consequences of this major silent killer and Mishra and Sinha 'rule of halves' points at callousness by health care providers, policy makers and equipment manufacturers. This is depicted in fig. 3.

To ensure a productive long life this giant killer must be tamed. We the health care experts are the able ones who can shoulder this responsibility.

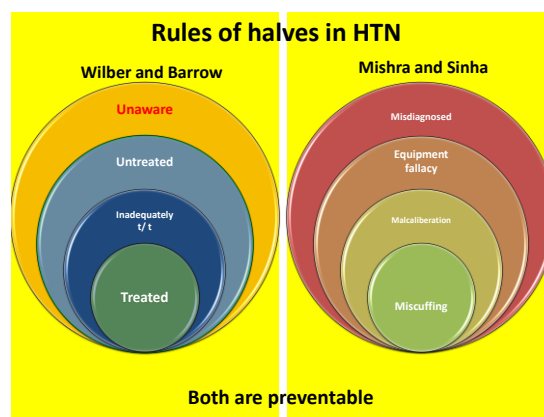


Fig. 3

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### Author's contribution

BNM developed the concept and wrote the manuscript. NS searched literature, wrote and edited the work. SCM was instrumental for inputs at conceptual stage and final designing of manuscript.

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