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Original Research Article

Standard operating procedure for the management of hypertensive urgencies in a community health centre in rural Tamil Nadu: a quality improvement project

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ABSTRACT

Background: Hypertension is one of the heaviest health care burdens in rural India where less than 1/10th of patients has blood pressures under control. This sheds limelight on community healthcare centers to proactively prevent, manage and treat hypertension and its complications. St. Ann's Hospital is one such CHC located in the Elathigiri subdisrtict of Tamil Nadu. We formulated a standard operating procedure at the CHC for the effective prevention and treatment of hypertensive urgency- one of the easily treatable but highly impactful complications of hypertension. We then strengthened its usage using plan-do-study-act cycles
Methods: An SOP was formulated using international and national guidelines, contoured to the low resources present at the center. Healthcare workers were trained to follow the SOP. Sequential PDSA cycles were then used to evaluate and control the step-ladder of barriers in effective management. The results were analyzed using indicators and compared to baseline values established at the start of the study.
Results: A rise of 41.4% was seen in correct SOP execution at the end of PDSA-2. At the end of the study, there was a 22% increase in the percent of patients correctly diagnosed, 19% increase in patients stabilized in the first hour and 14% increase in patients returning for follow up visits ($p<0.05$).
Conclusions: Our SOP could significantly reduce the burden of HU at the CHC. We encourage its usage in similar low resource centers and promote PDSA cycles as a method to ensure its efficient utilization.

Keywords: Hypertensive urgency, Hypertensive crises, SOP, PDSA, Rural

INTRODUCTION

In the year 2003, the terms malignant hypertension and accelerated hypertension were widely replaced by an umbrella diagnosis of "hypertensive crisis" containing two specific sub categories: hypertensive urgency (HU) and hypertensive emergency (HE).[2] According to the 7th edition of the joint national commission (JNC), hypertensive emergencies were classified as "severe elevations in blood pressure (BP) (>180/120 mmHg), complicated by evidence of impending or progressive target organ dysfunction" and the latter defined as "situations associated with severe elevations in BP (>180/120) without progressive target organ dysfunction".[2] Signs of target organ damage include: dissecting aortic aneurysm, hypertensive encephalopathy, acute myocardial infarction, intracerebral hemorrhage, acute heart failure, pulmonary edema, unstable angina, or preeclampsia/eclampsia. Before a diagnosis of HU is established, each of the above clinical features should be clearly ruled out, not only because the under diagnosis of HE is vastly life threatening but also because the treatment of either category of patients differs greatly.[3] While HE can only be adequately managed in an ICU setting with titratable intravenous agents, the management of HU can be executed at an outpatient setting with easily

available oral medication.[4] With the ever-growing burden of hypertension in India, the need for appropriate management and prevention of urgencies plays a prime role. Currently, over 35% of India's urban and 25% of its rural population is hypertensive.[2] Being a developing country, the lack of appropriate management protocols and healthcare infrastructure contribute to the harsh reality that less than a tenth of hypertensive patients in rural India have blood pressures under control.[1] Literature also shows that uncontrolled blood pressures; presumably due to medication noncompliance is the highest predisposing factor to develop hypertensive crises in the near future.[6]

In rural settings, community health centers (CHCs) play a major role in the effective management and prevention of hypertensive crises. St. Ann's Hospital, located in the Elathagiri, among the foot-hills of the Krishnagiri District in Tamil Nadu, is one such CHC that oversees a population of over 100,000 people dispersed among 20 surrounding villages. The hospital is situated within the area of the Settipalli primary health center and has one emergency department, a male ward and a female ward with 15 in-patient beds each, along with a single bedded private ward. It renders comprehensive emergency healthcare and outpatient department services that mainly tend to patients bitten by venomous snakes, a prevalent issue in the sub-districts of Krishnagiri.[7] Off-late, the hospital has been seeing an increase in the number of ambulatory patients with comorbidities such as diabetes and hypertension. The hospital is equipped with an ECG machine and basic cardiac emergency drugs including loading doses for myocardial ischemia, calcium channel blockers, diuretics, beta blockers and inotropic agents. There is a single resident medical officer (RMO) and 3 nurses working in shifts to monitor patients over 24 hours. Emergencies that cannot be handled with the above amenities are then referred to a higher center. Due to the increased frequency of hypertensive urgencies and the lack of an appropriate protocol adjusted to the low resources present at the center, the RMO emphasized on the need to develop a standard operating procedure (SOP) and train hospital staff with the devised protocol. A similar theme was relayed while observing the results of focused group discussions and brief interviews with past RMOs and healthcare workers of the hospital.

A conclusion was ascertained that an SOP and repeated training of staff via consequent Plan-Do-Study-Act (PDSA) cycles would hence effectively manage patients presenting during RMO's off-duty time. Keeping the above agenda in mind, a group was formed to implement an SOP using standardized international, national and state health welfare guidelines while understanding the underlying theme of in-sufficiency of resources and cost-effectiveness. A quality improvement project (QIP) was then conducted using the SOP to ensure the appropriate management of hypertensive urgencies.

Objectives

Objectives of the current study were to formulate an SOP for the effective management of HUs in a low resource setting using data from the 2017 guideline for the prevention, detection, evaluation, and management of high blood pressure in adults, in accordance with the availability of resources and recommendations from the national rural health mission (NRHM) and to ensure effective management of hypertensive crises in the community health center using sequential PDSA cycles.

METHODS

Study design, location and duration

The study design aligns with that of a QIP, which belongs to the category of cross-sectional studies. It was performed in a community health center in rural Tamil Nadu over the course of a year containing PDSA cycle durations of 2 months each. The first 4 months were used to analyze charts from patients evaluated in the previous year to establish a baseline of data.

Inclusion criteria

All consenting adult patients that adhered to the JNC-7 criteria of hypertensive crisis defined as BP>180/120, who visited the hospital in the course of 1 year were included in this study (n=348).

Exclusion criteria

No exclusion criteria were justified for use in this study

Procedure

An SOP for the management of hypertensive urgencies was formulated by the QIP team consisting of myself-a resident medical officer, past RMOs of the hospital and registered nurses. The standard was made to abide by the guideline present in the 2017 American College of Cardiology Report and include inputs from the NRHM guidelines on the management of hypertension in a rural setting.[4,8,9] It was then approved by the department of medicine, St. John's medical college and printed out as the official protocol for use in the treatment of hypertensive urgencies at the community health center. It was placed at various treatment points i.e. the entrance and emergency trolley station of the emergency ward to ensure appropriate visibility and compliance with protocol. The guideline used is portrayed in (Figures 1-3). 4 PDSA cycles of 2 months each were then performed to assess the implication of the SOP on the effective management of HUs. At the beginning of each PDSA cycle, an evaluation of previous or baseline performance and ways to overcome inadequacies was carried out (plan). It was then followed through using interventions contoured to solving issues recognized in the plan stage (do). Effectiveness of the management of the issues was

observed (Study) and the implications were understood qualitatively and quantitatively by using indicators described in (Table 1) (Act). An example of the first PDSA cycle is diagrammatically represented in (Figure 4) in a flowchart form.

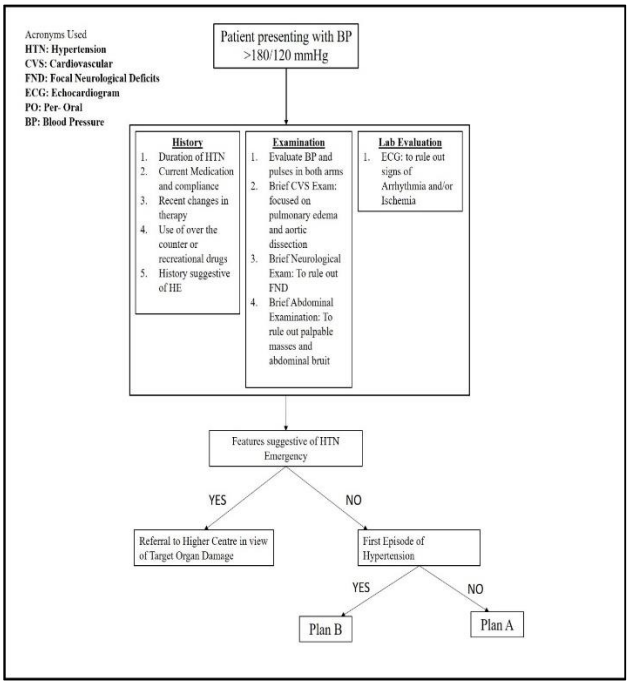

Figure 1: Approach to management of hypertensive crisis in a community health centre in rural Tamil Nadu.[4,8,9]

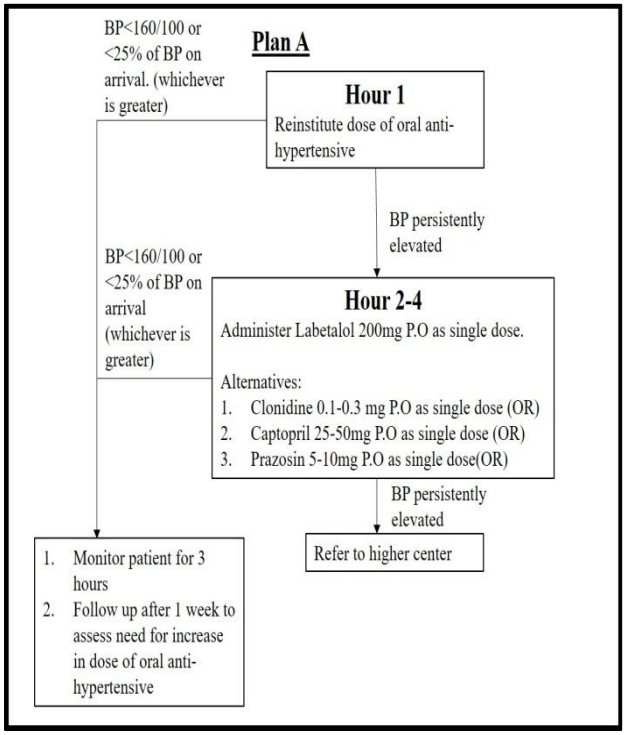

Figure 2: Management of hypertensive urgency in a known case of HTN.[4,8]

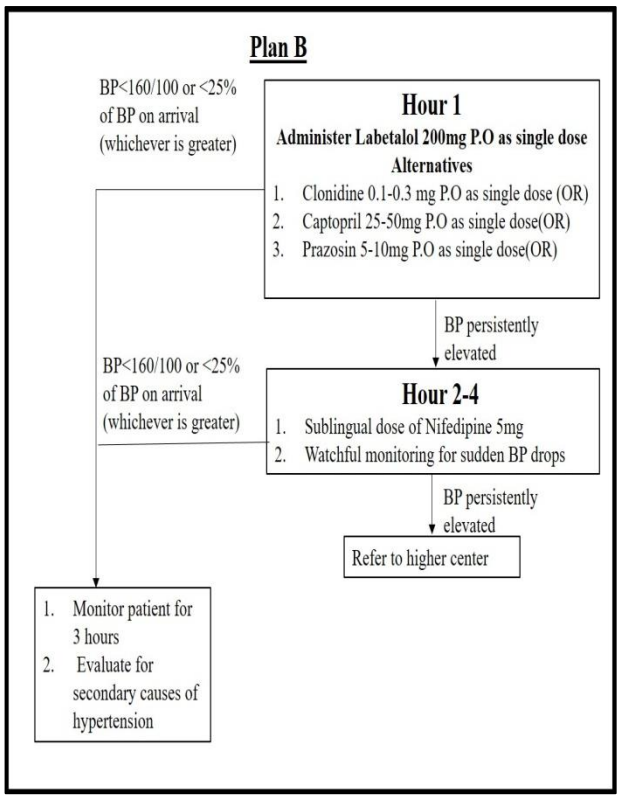

Figure 3: Management of hypertensive urgency in a new case of HTN.[4,8]

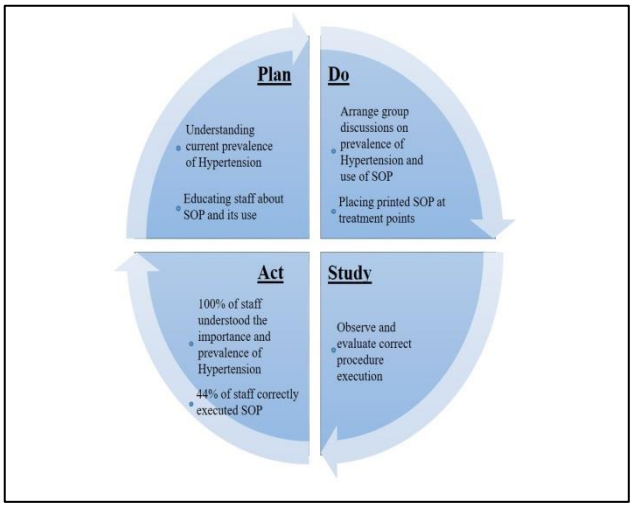

Figure 4: Diagrammatic representation of PDSA cycle 1.

Statistical analysis

Data was input using spreadsheets and was analyzed based on demographic characteristics as well as quantitative indicators of assessment using SPSS version 26. Statistically significant data was then reported at an alpha level of 0.05. Demographic data was analyzed using descriptive statistics and significance was calculated using correlational analysis i.e. Chi-Square test. Each test was two tailed.

RESULTS

Demographic characteristics

A total of 348 patients with hypertensive urgency were seen in the course of 8 months at the CHC. Out of these patients, 84 were seen in the first PDSA. 79, 89 and 96 were seen in the second, third and fourth cycles respectively. The increasing trend in the number of patients diagnosed with hypertensive urgency, especially in the fourth PDSA sheds a positive light on the efficacy of the cycles. The median range of patients ranged from 50-52 years with the mean age being 51.25 years. A male predominance was seen among patients and more than 50% of known hypertensives were not compliant to their medication. This is in congruence with the fact that the highest risk factor for HU is non adherence to medication.[6] Other key demographic data is detailed in (Table 2).

Table 1: Establishing indicators for analysis of PDSA cycles.

Indicator	Measurement
Percentage of patients correctly diagnosed with hypertensive urgency	$\frac{\text{No. of patients with Hypertensive Urgency}}{\text{Total No. of patients with Hypertensive Crises}}$ x 100
Percentage of patients appropriately stabilized within 1 hour of arrival	$\frac{\text{No. of patients with BP} < \frac{180}{120} \text{ within the 1st hour of treatment}}{\text{Total no. of patients with Hypertensive Urgency}}$ x100
Percentage of patients requiring referral due to non-resolving hypertensive urgency	$\frac{\text{No. of patients referred to a higher centre}}{\text{Total no. of patients with Hypertensive Urgency}}$ x100
Percentage of patients returning for the first follow up visit	$\frac{\text{No. of patients returning for the first follow up visit}}{\text{Total no. of patients with Hypertensive Urgency}}$ x100

Table 2: Highlighting key demographic characteristics of each PDSA cycle.

Variables	PDSA-1 (n=84)	PDSA-2 (n=79)	PDSA-3 (n=89)	PDSA-4 (n=96)
Median age (IQR) (years)	51 (43-61)	52 (42-60)	50 (43-61)	52 (44-60)
Female sex, N (%)	44 (52)	40 (50.6)	43 (48.3)	51 (53.1)
Median systolic BP (IQR) (mmHg)	200 (180-210)	205 (180-220)	200 (180-220)	200 (180-210)
Median diastolic BP (IQR) (mmHg)	110 (96-124)	110 (90-125)	110 (90-130)	110 (92-125)
Lower socioeconomic status, N (%)	70 (83.3)	65 (82.3)	71 (79.7)	75 (78.12)
Known hypertensive, N (%)	80 (95.2)	71 (89.8)	82 (92.1)	89 (92.7)
Compliant to medication, N (%)	29 (36.25)	29 (40.8)	42 (51.2)	43 (48.31)

PDSA cycle 1 (2 months)

The aim of the first PDSA cycle was two-fold. Firstly, to enable key healthcare workers (HCWs) at the CHC to understand the severity of hypertensive crises; their mortality and morbidity and secondly, to introduce the SOP to HCWs at the center. The above was implemented using weekly group discussions on hypertensive crises and guidelines for management. Data saturation was reached 6 weeks into the start of the cycle. The SOP was then printed and placed at treatment points in the hospital. Each HCW was individually instructed to follow SOP guidelines and propose any incongruences occurring at the time of patient management to the RMO. HCWs were then tested at the end of the cycle with an oral questionnaire. It was observed that 100% of HCWs understood the importance and prevalence of hypertension, while only 41.6% (5 out of 12) of them executed the SOP correctly. This posed that the second PDSA cycle focused on improving the correct execution of the SOP.

PDSA cycle 2 (2 months)

The main theme identified at the start second cycle of the PDSA was the lack of correct execution the SOP. Using a written questionnaire each HCW was allowed to express individualized reasons for failure to adhere to the protocol, leaving no room for observer related bias. The results of the questionnaire pointed towards difficulty in understanding terms such as "focal neurological deficits" and signs of pulmonary edema. To improve the outcome of this PDSA cycle, a group an interactive session was arranged among HCWs, where each HCW would demonstrate brief CVS, Neurological and Abdominal Exam on their tem partner and vice versa. Post the group activity, a drastic increase in all indicators of the PDSA was noted with a p value <0.05 as portrayed in (Table 2). The QI team also proposed to have weekly teaching modules to explain complex medical terms in colloquial languages using translators. Each healthcare worker was then monitored for correct execution of the SOP and there was a 41.4% increase in correct SOP execution with 10 out of 12 HCWs correctly managing patients of HU.

PDSA cycle 3 (2 months)

Underlying issues identified for the third PDSA cycle was; lack of compliance of patients with HTN to medication and that, less than 10% of patients with HU returned for follow up visits. The key determinants of the above outcome were analyzed by briefly interviewing HU

patients at the hospital and themes of; lack of knowledge on the need for follow up and "taking medication only when I feel like my BP is high" was observed. This called to counsel all patients on the need for medication adherence and perseverance to follow up. Patients were explained the need for regular BP monitoring and affordable patients were encouraged to use monitoring devices instead of relying on subjective symptoms. At the end of PDSA cycle 3 a small but statistically significant increase of 3% was seen in patients coming for follow up after 1 week. Increasing trends were also witnessed in all other indicators apart from the percentage of patients referred to a higher center with $p<0.05$.

Table 3: Assessing indicators after PDSA cycles 2, 3 and 4.

Indicator	Baseline 2020 (%)	PDSA-2 (%)	PDSA-3 (%)	PDSA-4 (%)
Percentage of patients correctly diagnosed with HU	62	73	76	84
Percentage of patients stabilized within the first hour of arrival	28	34	41	47
Percentage of patients requiring referral	15	20	20	18
Percentage of patients returning for the first follow up visit	8	10	13	22

PDSA cycle 4 (2 months)

The 4th PDSA cycle concentrated on improving indicators of follow up and medication adherence. In 2017, Amy et al proved that loss to follow up in randomized controlled trials was decreased using incentives for study participants.[10] Extrapolating a similar theme to this study we used free BP measurement on follow up as an incentive for patients. Counselling of patients on medication adherence was given prime importance during these sequential follow ups. Posters were placed at the entrance of the hospital emphasizing on common symptoms of hypertensive crises and patient's attenders were counselled to observe patients' compliance to medication. Following the 4th PDSA cycle, large improvements were seen from the baseline values of indicators. At a significance level of 0.05, there was a 22% percent increase in the number of patients correctly diagnosed with HU. ($p=0.00045$) and 19% increase patients stabilized within the first hour ($p=0.0055$). A non-statistically significant increase of 3% was seen in the percentage of patients requiring referral ($p=0.3266$) and a 14% increase was seen in the percent of HU patients returning for the first follow up visit ($p=0.005$).

DISCUSSION

PDSA cycles are well known methods to improve the quality of healthcare in a given scenario.[11] Through our study we not only tackled a high-rising healthcare burden i.e. HTN but also identified key methods through which simple solutions can be utilized for complex healthcare problems. For example, in PDSA 2 we observed that interaction-based group learning improved the efficacy of SOP execution by twice the value at PDSA-1. In PDSA-4 our usage of free BP measurement as an incentive to follow up contributed to an overall 14% increase from the baseline indicator. We also learnt that the key to an effective SOP lies not only on its formation but also in its implementation. Through PDSA cycles 1 and 2 we aimed to correctly implement the SOP and develop methods for active learning of HCWs. Through PDSA 3 and 4 we encouraged adherence to HTN medication and motivated patient follow up which increased 3 out of 4 baseline indicators by statistically significant level.

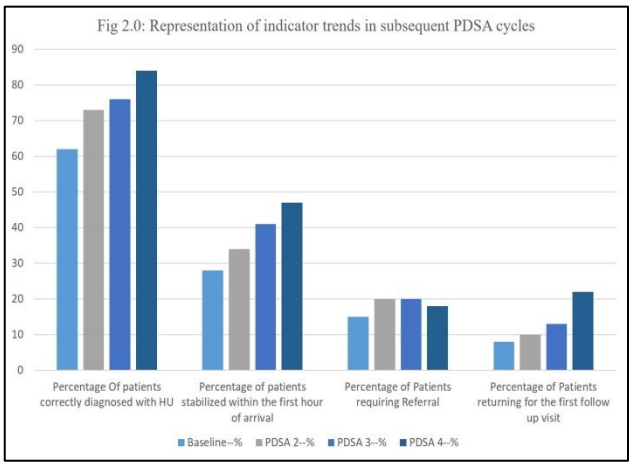

Figure 5: Representation of indicator trends in subsequent PDSA cycles.

The Plan stage of each PDSA was cemented on the Act stage of the previous PDSA. Our study also emphasized on the need for productive methods to encourage patient follow up as although an overall increase of 14% was seen from baseline, the percentage of HU patients returning for the first follow up visit still remained below 25%. Various issues encountered while executing PDSA cycles included difficulties in translating complex medical terms (PDSA-1) and difficulties in effective monitoring of HCW without formation of a Hawthorne bias (PDSA-2).[12] By overcoming these difficulties using translators and blinded questionnaires, we were able to adeptly formulate an SOP that can be used for treatment of hypertensive urgencies in resource limited areas and effectively use QIP-PDSA methods to improve the quality of healthcare at the CHC. Due to lack of studies on the underlying motif, we encourage physicians and

healthcare workers in rural areas to use our standard of procedure and develop sequential PDSA and hence reduce the burden of hypertension in rural India and world over.

Limitations

Several biases were encountered while carrying out this study, including Hawthorne effect while observing implementation of SOP by HCWs and reporting bias as this study includes results obtained only from a single center. A multi-centric study with continuous circulation of HCWs and assessment of indicators at more frequent intervals would hence objectively validate its role in a larger population.

CONCLUSION

In conclusion, this study showed that an SOP which is curated to the resources in a backward area can effectively manage the burden of a disease such as hypertensive emergency. Even though various hurdles were faced during its implementation, over the course of a year divided into 4 PDSA cycles, a significant increase in the quality of healthcare delivered was noted at the CHC.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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