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Short Communication

Impact of 90-day integrative therapy on ambulatory blood pressure parameters in patients with white coat effect: a preliminary retrospective observational study

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ABSTRACT

Hypertension diagnosis based on clinic blood pressure measurements is often confounded by the white coat effect, leading to potential misclassification and overtreatment. Ambulatory blood pressure monitoring provides a more accurate assessment of true blood pressure patterns and therapeutic response. A retrospective, multicentric, observational study was conducted at Madhavbaug clinics across India from December 2022 to April 2025. Patients aged 18 years and above diagnosed with white coat effect on ambulatory blood pressure monitoring and participated in the Blood Pressure Management Program were studied. Data from day 1 was compared with data from day 90. A total of 12 patients were studied. Improvement in daytime ambulatory systolic blood pressure (day 1: 143.92±7.39 mmHg and day 90: 123.83±7.10 mmHg), nighttime ambulatory systolic blood pressure (day 1: 135.25±7.67 mmHg and day 90: 114.83±10.20 mmHg), daytime ambulatory diastolic blood pressure (94.42±5.87 mmHg and 79.83±6.91 mmHg), and nighttime ambulatory diastolic blood pressure (day 1: 86.50±8.07 mmHg and day 90: 72.00±10.53 mmHg) at 90 days were improved. Ayurveda and Panchakarma significantly decreased ambulatory blood pressure parameters and eliminated white coat effect in patients without adverse side effects. Controlled trials are needed to confirm the positive outcome of this promising alternative treatment for hypertension.

Keywords: Ayurveda, Ambulatory blood pressure monitoring, Hypertension, Panchakarma

INTRODUCTION

Hypertension is a highly prevalent global health condition and a major contributor to cardiovascular morbidity and mortality. It is responsible for approximately 13.5% of premature deaths worldwide and contributes to nearly 54% of strokes and 47% of ischemic heart disease cases globally.[1] The World Health Organization estimates that nearly 1 in 3 adults worldwide live with hypertension.[2] In India, the prevalence of hypertension ranges from 24%–30% in urban populations and 12%–14% in rural populations.[3] Despite its widespread prevalence, early detection of hypertension remains challenging, as elevated blood pressure is frequently asymptomatic in its initial stages. The 2017 American College of Cardiology/American Heart Association (ACC/AHA) guidelines recommend initiation of antihypertensive therapy primarily based on clinic blood pressure measurements.[4] However, clinic blood pressure provides only a single-time-point assessment and may not accurately reflect an individual's true blood pressure status. Readings may be falsely elevated or underestimated due to factors such as the white coat effect or masked hypertension.[5] Furthermore, Clinic measurements do not capture diurnal blood pressure variation or adequately assess the impact of antihypertensive therapy on blood

pressure variability. Ambulatory blood pressure monitoring addresses these limitations by providing multiple measurements over a 24-hour period, reducing false readings and offering valuable insight into circadian blood pressure patterns and treatment response.[6] Hypertension is a modifiable risk factor, and both non-pharmacological and pharmacological interventions have been shown to significantly reduce cardiovascular risk. Common pharmacological therapies include beta-blockers, angiotensin-converting enzyme inhibitors, diuretics, and calcium channel blockers.

However, these medications are frequently associated with adverse effects such as dizziness, headache, frequent micturition, dry cough, gastrointestinal disturbances, weakness, and sleep disturbances. The burden of these side effects, along with issues related to long-term adherence and cost, underscores the need for alternative or adjunctive treatment strategies that are effective, safe, and economically viable.[7]

Ayurveda, a traditional system of medicine, has been employed in the management of various chronic conditions, including hypertension. Several herbal formulations have demonstrated blood pressure–lowering effects comparable to conventional therapies.[8] Ayurvedic management of hypertension typically incorporates lifestyle modification, dietary interventions, and Panchakarma therapies. These include detoxification techniques such as Snehana (external oleation therapy) and Swedana (passive heat therapy), along with rejuvenative procedures like Shirodhara, which involves the continuous pouring of medicated oil over the forehead. Given the potential role of Ayurvedic interventions in blood pressure regulation and the advantages of ambulatory blood pressure monitoring in accurately assessing blood pressure dynamics, this retrospective observational study was planned to evaluate the effect of a 90-day integrative Ayurvedic therapy on ambulatory blood pressure parameters in patients exhibiting the white coat effect.

METHODS

Study design and patient population

A retrospective, multicentric, observational study was conducted at Madhavbaug clinics across India from December 2022 to April 2025. Patients aged 18 years and above diagnosed with white coat effect on ambulatory blood pressure monitoring and participated in the Blood Pressure Management Program were studied. White coat effect on ambulatory blood pressure monitoring was defined as a clinic-measured systolic blood pressure ≥140 mm Hg with a daytime or 24-hour ambulatory average <135 mm Hg.

The exclusion criteria were patients with: (i) type 2 diabetes mellitus, (ii) secondary hypertension, (iii) acute illness or hospitalization, (iii) pregnancy or lactation. (iv) incomplete or poor ambulatory blood pressure monitored readings (<80% valid readings), (v) inadequate adherence to prescribed medication, (vi) major changes in antihypertensive medication, and (vii) incomplete follow-up data. Signed informed consent for the procedure, data collection and its analysis for research purposes was obtained from each patient.

Blood pressure management program

The Blood Pressure Management Program consists of a total of 12 sessions conducted over a period of 3 months, with 4 sessions each in the first, second, and third months. Participants continued to receive conventional allopathic treatment where antihypertensive medication had been prescribed. The protocol comprised 3 sequential procedures, with each session lasting approximately 65–75 mins, and was administered to hypertensive patients after a light breakfast.

The first procedure, Snehana, involved external oleation using R Abhyanga oil. The oil was massaged over the hands, legs, shoulders, thorax, abdomen, and back using centripetal strokes directed towards the heart. The massage was performed for approximately 30 mins and is believed to enhance peripheral circulation and exert an anxiolytic effect. The second procedure, Swedana, involved passive heat therapy inducing thermal vasodilation.

A Dashmoola (group of 10 herbs) decoction was administered at a temperature not exceeding 40°C for a duration of 10–15 minutes. The patient was positioned supine inside a wooden steam box, with the neck exposed outside the chamber. This procedure promotes sweating, facilitating the elimination of excess salt and water from the body. Following the treatment, patients were allowed to rest for 3–4 minutes, with the total duration of the procedure being approximately 15–20 minutes. The third procedure, Shirodhara, involved the continuous dripping of lukewarm decoction from a fixed height onto the medial forehead and eyebrow region in an oscillatory manner. Care was taken to prevent the decoction from entering the eyes or ears. The procedure was conducted for 20 mins and is believed to reduce stress-related hormones such as adrenaline and noradrenaline, thereby inducing mental relaxation.

Study endpoints

The primary endpoint of the study was improvement in white coat effect 90 days after treatment.

Statistical analysis

Categorial data are indicated as number (percentage) whereas continuous data are indicated as mean ± standard deviation. The difference between baseline and follow-up at 90 days was determined with the paired t test. p value ≤ 0.05 was considered statistically significant. Software used for data analysis was R Version 3.4.1.

RESULTS

Baseline and 90-day clinical outcomes

A total of 12 patients were studied. The mean age of the study patients was 46.50±6.92 years and 8 (66.7%) patients were male. Improvement in daytime ambulatory systolic blood pressure (day 1: 143.92±7.39 mmHg and day 90: 123.83±7.10 mmHg), nighttime ambulatory systolic blood pressure (day 1: 135.25±7.67 mmHg and day 90: 114.83±10.20 mmHg), daytime ambulatory diastolic blood pressure (94.42±5.87 mmHg and 79.83±6.91 mmHg), and nighttime ambulatory diastolic blood pressure (day 1: 86.50±8.07 mmHg and day 90: 72.00±10.53 mmHg) at 90 days was observed. The baseline and 90-day clinical outcomes are elaborated in Table 2.

Table 1: Treatment program.

Steps involved	Product	Mechanism of action	Duration (mins/sitting)	Probable adverse effects
Step 1 Therapeutic oleation	R-abhyanga oil	Reduces vata, improves circulation, deep nourishment	30	Skin irritation, itching, rash
Step 2 Thermal vasodilatation	Dashmool kadha	Anti-inflammatory, detoxifying, balances vata and pitta	20	Gastrointestinal upset (nausea, loose stools, abdominal discomfort)
Step 3 Shirodhara	V.D.B. Oil (erandmool, dashmool til oil)	Anti-inflammatory, pain relief, supports musculoskeletal healing	20	Skin irritation or contact dermatitis rare systemic effect: mild laxative action (due to erandmool, if absorbed in excess)

Table 2: Baseline and 90-day clinical outcomes.

Variable	Day 1 (n=12)	Day 90 (n=12)	p value
Age, years	46.50±6.92		
Males, (N)	8 (66.7%)		
Weight, kg	78.43±10.51	72.70±9.82	0.00
Body mass index	29.75±3.65	27.50±3.12	0.00
Ambulatory blood pressure			
Systolic blood pressure, mmHg (day)	143.92±7.39	123.83±7.10	0.00
Systolic blood pressure, mmHg (night)	135.25±7.67	114.83±10.20	0.00
Diastolic blood pressure, mmHg (day)	94.42±5.87	79.83±6.91	0.00
Diastolic blood pressure, mmHg (night)	86.50±8.07	72.00±10.53	0.00

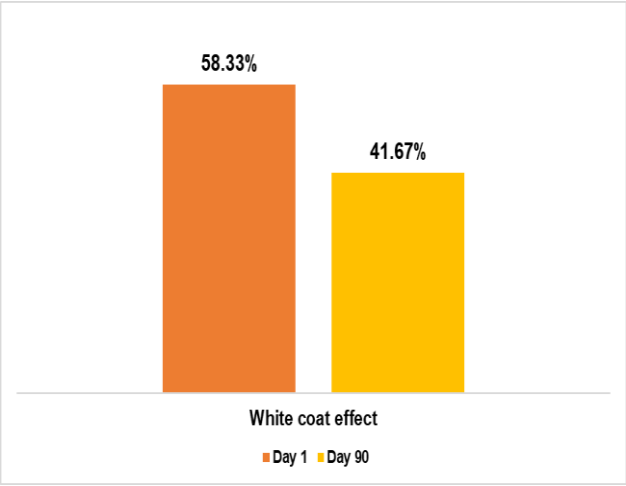

Figure 1: White coat effect.

White coat effect

Of the 12 patients, 7 (58.33%) did not have the white coat effect and 5 (41.67%) had the white coat effect at the 90-day follow-up, as shown in Figure 1.

DISCUSSION

The primary endpoint of the current study was improvement in white coat effect 90 days after treatment. Study findings revealed 58.33% patients did not have the white coat effect after 90 days of treatment. Improvement in daytime ambulatory systolic blood pressure (day 1: 143.92±7.39 mmHg and day 90: 123.83±7.10 mmHg), nighttime ambulatory systolic blood pressure (day 1: 135.25±7.67 mmHg and day 90: 114.83±10.20 mmHg), daytime ambulatory diastolic blood pressure (94.42±5.87 mmHg and 79.83±6.91 mmHg), and night time ambulatory diastolic blood pressure (day 1: 86.50±8.07

mmHg and day 90: 72.00 ± 10.53 mmHg) at 90 days was observed.

These findings are in line with an earlier similar study assessing efficacy of the Blood Pressure Management Program that documented daytime ambulatory systolic blood pressure (day 1: 123.71±11.83 mmHg and day 90: 123.12±12.36 mmHg), night-time ambulatory systolic blood pressure (day 1: 114.76±13.41 mmHg and day 90: 114.31±14.40 mmHg), daytime ambulatory diastolic blood pressure (day 1: 77.03±8.28 mmHg and day 90: 76.31±9.45 mmHg, and night-time ambulatory diastolic blood pressure (day 1: 69.53±8.32 mmHg and day 90: 68.42±8.85 mmHg) improvements at the 90-day follow-up.[9] The Blood Pressure Management Program has been described earlier. In an elderly male population systolic blood pressure (day 1: 150.67±12.97 mmHg and day 90: 126.0±13.01 mmHg), diastolic blood pressure (day 1: 87.79±7.72 mmHg and day 90: 76.91±7.59 mmHg), and mean arterial pressure (108.75±7.14 mmHg and day 90: 93.25±8.72 mmHg) improved at the 90-day follow-up.10 In overweight and obese males, systolic blood pressure, diastolic blood pressure, and mean arterial pressure improved by 25.57 mmHg, 12.96 mmHg, and 17.41 mmHg, respectively.[11]

An important observation of the present study is the consistent reduction in both daytime and nighttime ambulatory blood pressure parameters, suggesting a sustained effect beyond transient clinic-related anxiety. The white coat effect is primarily mediated by heightened sympathetic nervous system activity and stress-related neurohumoral responses occurring during medical encounters.[12,13] Integrative interventions incorporating relaxation therapies and passive heat exposure have been shown to modulate autonomic balance by reducing sympathetic tone and enhancing parasympathetic activity.[14,15] Procedures such as Snehana, Swedana, and Shirodhara may therefore contribute to blood pressure reduction through anxiolytic effects, improved vascular compliance, and attenuation of stress hormone release. Passive heat therapy has been associated with vasodilation, improved endothelial function, and reductions in systemic vascular resistance, all of which are relevant to blood pressure regulation.[16] Furthermore, the observed improvement in nocturnal blood pressure parameters suggests a favourable influence on circadian blood pressure rhythms, which is clinically significant given that non-dipping patterns are independently associated with increased cardiovascular risk.[17]

Limitations

This study has a few limitations, including a small sample size, a retrospective single-arm design limiting generalisability, and a short follow-up period that precludes assessment of long-term outcomes. Larger prospective comparative studies with extended follow-up are warranted to further evaluate the long-term effectiveness of the Blood Pressure Management Program in hypertension management.

CONCLUSION

The study demonstrated that 90 days integrative therapy significantly improved 24-hour ambulatory blood pressure parameters in patients exhibiting the white coat effect. Both systolic and diastolic pressures demonstrated sustained reductions, accompanied by restoration of nocturnal dipping and attenuation of the white coat effect amplitude. These findings suggest that integrative, therapy effectively modulates autonomic and vascular responses associated with the white coat effect, providing stable blood pressure control beyond clinic settings. The approach was well tolerated with no adverse effects.

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