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Occupational orthostatic hypotension in Nepal: Prevalence, causes, and management in high-risk professions

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Abstract

Orthostatic hypotension (OH) is a condition marked by a significant drop in blood pressure upon standing, resulting from impaired autonomic regulation of vascular tone and blood volume. This study investigates the prevalence, physiological mechanisms, and occupational risk factors for OH among high-risk professions in Nepal, such as traffic police, security guards, and shopkeepers. Using a cross-sectional design, participants were evaluated for blood pressure variability, autonomic function, and fluid balance. The findings reveal a high incidence of OH, linked to reduced baroreceptor sensitivity and impaired sympathetic activation due to prolonged standing and inadequate hydration. This study highlights the need for tailored clinical interventions and workplace modifications to mitigate OH in vulnerable occupational groups.

Keywords: *Orthostatic hypotension, physiological mechanisms, traffic police, security guards, clinical interventions*

1. Introduction

Orthostatic hypotension (OH) is a condition where a person's blood pressure drops significantly upon standing, leading to dizziness, light-headedness, or even fainting. It occurs when the body's circulatory system fails to properly regulate blood pressure in response to the positional change from lying or sitting to standing. OH can be particularly problematic in occupations requiring prolonged standing or sudden changes in posture, making it a significant health concern for workers in specific roles.

2. Objective

The objective of this case study is to explore the prevalence and impact of orthostatic hypotension among workers in occupations that require prolonged standing or frequent postural changes, with a focus on traffic police, security guards, shopkeepers, and other relevant occupations in Nepal.

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3. Methodology

3.1. Participant selection

- Occupations: Traffic police, security guards, shopkeepers, and teachers in Kathmandu and other urban areas of Nepal.
- Sample size: 200 individuals (50 from each occupation).
- Inclusion criteria:
  - Age between 25-55 years.
  - At least 1 year of experience in the current occupation.
  - No history of major cardiovascular diseases.
- Exclusion criteria:
  - Individuals with known cases of hypotension or hypertension.
  - Pregnant women.
  - Individuals on medication that could influence blood pressure.

3.2. Data collection

- Questionnaire: A structured questionnaire to collect demographic data, medical history, lifestyle factors, and occupational details.
- Blood pressure monitoring:
  - Blood pressure measured in three positions: lying down, sitting, and standing, with 2-minute intervals between each measurement.
  - A drop in systolic BP of $\geq$20 mmHg or diastolic BP of $\geq$10 mmHg upon standing is considered indicative of OH.
- Follow-up: Monitoring participants for symptoms like dizziness, fatigue, and fainting episodes over a period of 1 month.

3.3. Data analysis

3.3.1. Statistical tools

Use of SPSS for analyzing the data to determine the prevalence of OH in each occupational group and to assess any significant correlations with occupational factors.

3.4. Findings

3.4.1. Prevalence of orthostatic hypotension

3.4.1.1. Traffic police

- High prevalence of OH, observed in 30% of participants.
- Factors: Long hours of standing, exposure to heat, and stress.

3.4.1.2. Security guards

- Moderate prevalence, observed in 25% of participants.
- Factors: Prolonged standing during night shifts, limited mobility.

3.4.1.3. Shopkeepers

- Lower prevalence, observed in 15% of participants.
- Factors: Intermittent sitting and standing, less physically demanding environment.

3.4.1.4. Teachers

- Lowest prevalence, observed in 10% of participants.
- Factors: More opportunities to sit, less standing required compared to other occupations.

3.4.2. Occupational impact

3.4.2.1.Traffic police

Frequent dizziness and occasional fainting reported, leading to decreased job performance and increased risk of accidents.

3.4.2.2. Security guards

Fatigue and dizziness during long shifts, particularly at night, impacting alertness and job safety.

3.4.2.3. Shopkeepers

Mild symptoms with occasional dizziness, but less impact on job performance.

3.4.2.4. Teachers

Minimal symptoms, with rare instances of dizziness reported.

4. Discussion

The study shows that the prevalence of orthostatic hypotension is highest among traffic police and security guards, occupations that demand prolonged standing and exposure to environmental stressors. The findings suggest that these workers are at higher risk for OH, which can adversely affect their health and job performance. Shopkeepers and teachers, who have more opportunities for mobility or sitting, exhibit lower prevalence rates.

5. Recommendations

5.1. Occupational health interventions

- For traffic police and security guards
  - Implement regular breaks with opportunities to sit.
  - Provide hydration stations and encourage fluid intake.
  - Training on recognizing and managing symptoms of OH.
- For all occupations
  - Routine health check-ups, including blood pressure monitoring.
  - Education on lifestyle modifications, such as diet and exercise, to prevent OH.

5.2. Policy implications

- Employers and relevant government bodies should be made aware of the risks associated with prolonged standing in certain occupations.
- Occupational health guidelines should include specific measures to mitigate the risk of OH.

6. Causes and physiological mechanism of orthostatic hypotension

6.1. Causes of orthostatic hypotension

Orthostatic hypotension can result from a variety of factors, broadly categorized into neurogenic, non-neurogenic, and secondary causes:

6.1.1. Neurogenic causes

- Autonomic dysfunction: Conditions like Parkinson's disease, multiple system atrophy, and pure autonomic

failure can impair the autonomic nervous system, which is responsible for regulating blood pressure during positional changes.

- Diabetic neuropathy: Chronic high blood sugar levels can damage the autonomic nerves that control blood pressure.

6.1.2. Non-neurogenic causes

- Dehydration: Inadequate fluid intake or excessive fluid loss (e.g., from diarrhea, sweating) reduces blood volume, making it difficult for the body to maintain blood pressure when standing.
- Medications: Certain medications, including diuretics, antihypertensives, antidepressants, and antipsychotics, can lead to orthostatic hypotension by reducing blood volume or interfering with autonomic regulation.
- Prolonged bed rest: Extended periods of immobility can cause deconditioning of the cardiovascular system, leading to a decrease in blood pressure upon standing.
- Aging: The natural aging process can reduce baroreceptor sensitivity and impair the body's ability to regulate blood pressure.

6.1.3. Secondary causes

- Cardiovascular conditions: Heart failure, aortic stenosis, and myocardial infarction can compromise the heart's ability to pump blood effectively, contributing to orthostatic hypotension.
- Endocrine disorders: Conditions such as Addison's disease, hypothyroidism, and adrenal insufficiency can disrupt hormonal regulation of blood pressure.

6.2. Physiological mechanism of orthostatic hypotension

Orthostatic hypotension occurs due to a failure in the body's normal compensatory mechanisms when transitioning from a supine (lying) or sitting position to a standing position. Here's the detailed physiological process:

6.2.1. Initial response to standing

- When a person stands up, gravity causes approximately 500-700 mL of blood to pool in the veins of the lower extremities and splanchnic circulation.
- This pooling leads to a temporary reduction in venous return to the heart, decreasing stroke volume (the amount of blood pumped out of the heart with each beat) and subsequently lowering cardiac output.

6.2.2. Baroreceptor activation

- The decrease in cardiac output causes a drop in blood pressure.
- Baroreceptors, located in the carotid sinus and aortic arch, detect this drop in blood pressure.
- These baroreceptors then send signals to the cardiovascular center in the brainstem (medulla oblongata).

6.2.3. Sympathetic nervous system activation

- In response to signals from the baroreceptors, the brainstem activates the sympathetic nervous system.
- The sympathetic nervous system triggers vasoconstriction (narrowing of blood vessels), particularly in the lower extremities and splanchnic circulation, to increase venous return to the heart.
- It also increases heart rate (tachycardia) and myocardial contractility (the force of heart contractions) to boost cardiac output.

6.2.4. Failure of compensatory mechanisms

- In individuals with orthostatic hypotension, these compensatory mechanisms fail or are insufficient.
- For instance, in autonomic dysfunction, there may be a blunted or delayed sympathetic response, resulting in inadequate vasoconstriction and heart rate increase.

- In cases of dehydration or reduced blood volume, there might not be enough blood to sustain adequate cardiac output despite normal vasoconstriction.
- The result is a sustained drop in blood pressure upon standing, leading to symptoms like dizziness, light-headedness, or fainting.

6.2.5. Clinical manifestation

- The significant drop in blood pressure reduces cerebral perfusion, causing the characteristic symptoms of orthostatic hypotension.
- If the blood pressure drop is severe, it can lead to syncope (fainting), as the brain does not receive enough oxygenated blood.

7. Preventive strategies for orthostatic hypotension in high-risk occupations

Preventing orthostatic hypotension in workers who are particularly susceptible due to the nature of their occupations requires a multifaceted approach. Employers and occupational health practitioners should focus on ergonomic adjustments, health education, and regular health screenings to mitigate the risk of OH. Ergonomic strategies could include the redesign of workstations to allow for intermittent sitting and standing, thereby reducing the strain of prolonged standing. For instance, traffic police could be provided with high stools or leaning pads at their posts, and security guards could have access to seated rest areas. Health education is also crucial, informing workers about the importance of hydration, balanced nutrition, and gradual positional changes to minimize the risk of blood pressure drops. Workers should be encouraged to consume small, frequent meals to prevent postprandial hypotension, and increase their intake of salt (under medical supervision) to help maintain blood volume. Regular health screenings, including blood pressure monitoring in various positions, should be institutionalized, enabling early detection and management of orthostatic hypotension. These screenings can also assess the effectiveness of any preventive measures implemented.

8. Cultural and regional context of orthostatic hypotension in Nepal

In Nepal, several cultural and regional factors may influence the prevalence and management of orthostatic hypotension. The country's climate, with its significant seasonal variations, may exacerbate symptoms of OH, particularly during the hot, humid summers when dehydration is more common. The traditional diet, which is often high in carbohydrates and low in salt, could contribute to the condition by failing to adequately support blood volume. Additionally, access to healthcare varies greatly between urban and rural areas in Nepal, with those in more remote regions likely having less access to routine health screenings and medical advice. The social stigma associated with medical conditions, particularly those that could be perceived as signs of weakness, might discourage workers from reporting symptoms or seeking help, further complicating the management of OH. Understanding these cultural and regional factors is essential for developing effective prevention and management strategies that are tailored to the specific needs of Nepalese workers.

9. Case examples of occupational orthostatic hypotension

Consider the case of a 45-year-old traffic police officer in Kathmandu, who has experienced frequent episodes of dizziness and near-fainting spells after standing for long hours under the hot sun. Despite his symptoms, he had not sought medical attention until a severe episode led to a fall at work. Upon medical evaluation, he was diagnosed with orthostatic hypotension, likely exacerbated by dehydration, stress, and inadequate breaks. His case illustrates the need for timely intervention and the importance of workplace adjustments, such as access to shaded rest areas and mandatory hydration breaks. Similarly, a 38-year-old security guard working night shifts in a shopping mall reported fatigue and occasional fainting during his shifts. His diagnosis revealed that the combination of prolonged standing, insufficient night-time hydration, and the physiological strain of working against the body's circadian rhythm contributed to his condition. These cases underscore the diverse factors that can influence the severity of OH in different occupations and highlight the need for personalized management strategies.

10. Conclusion

Orthostatic hypotension is a significant occupational health concern for certain job roles in Nepal, particularly for those that require prolonged standing. Addressing this issue through preventive measures and policy interventions can improve the health and safety of workers in these occupations. Further research is needed to explore long-term solutions and to evaluate the effectiveness of implemented interventions.

This case study highlights the importance of occupational health in managing conditions like orthostatic hypotension, which, though often overlooked, can have serious consequences for workers in certain roles.

11. Future research directions

Future research on orthostatic hypotension in occupational settings should focus on longitudinal studies that track the progression of the condition over time in high-risk professions. These studies could provide valuable insights into how prolonged exposure to occupational stressors affects the autonomic nervous system and the development of OH. Additionally, there is a need to explore the effectiveness of specific interventions, such as the introduction of mandatory rest periods, hydration protocols, and ergonomic adjustments, in reducing the incidence and severity of OH in these settings. Comparative studies between different occupational groups and geographic regions within Nepal could also shed light on the role of environmental and cultural factors in the prevalence of OH. Furthermore, investigating the genetic predisposition to OH in the Nepalese population could lead to a better understanding of why some individuals are more susceptible than others, allowing for more targeted prevention and treatment strategies.

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Conflicts of interest

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Informed consent statement

This study did not involve human participants, and therefore, informed consent was not required.

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