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**ORIGINAL RESEARCH**

# Management of acute vertigo in emergency department

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## ABSTRACT

**Background:** Acute vertigo is a frequent cause of dizziness-related Emergency Department (ED) visits and can be diagnostically challenging due to its multifactorial etiology. Differentiating benign peripheral vestibular disorders, such as benign paroxysmal positional vertigo (BPPV) or vestibular neuritis, from central causes like cerebellar or brainstem stroke is of paramount importance to prevent morbidity and mortality. **Methods:** A prospective, observational study was conducted in a tertiary-care ED over 12 months. Adults with acute vertigo of fewer than 48 hours' duration were enrolled. Standardized clinical assessment included history, neurological examination, bedside vestibular evaluation (HINTS exam), and neuroimaging when indicated. Management strategies were etiology-directed: repositioning maneuvers or vestibular suppressants for peripheral causes, and urgent neuroimaging plus specialist consultation for suspected central pathology. **Results:** Among 300 patients, 68% were diagnosed with peripheral vestibular disorders, predominantly BPPV (36%) and vestibular neuritis (22%). Central etiologies accounted for 12% of cases and included ischemic events in the posterior circulation. The HINTS exam demonstrated a sensitivity of 95% and specificity of 90% in differentiating peripheral from central vertigo. Patients with peripheral vertigo benefited significantly from immediate repositioning maneuvers and vestibular suppressants. Those with central causes required urgent neuroimaging and specialist intervention; early diagnosis was associated with improved outcomes. **Conclusion:** Timely and accurate assessment of acute vertigo in the ED is essential to guide appropriate management and prevent adverse outcomes. Incorporating standardized clinical tools like the HINTS exam and using selective neuroimaging can streamline diagnosis and optimize patient care.

**Keywords:** Acute Vertigo, Emergency Department, HINTS Exam, Dizziness, Peripheral Vertigo, Central Vertigo, BPPV



## INTRODUCTION

Acute vertigo is a prominent cause of dizziness in the emergency setting, representing a substantial proportion of vestibular complaints and leading to considerable diagnostic dilemmas [1]. Vertigo is characterized by an illusory sensation of rotational or other motion, typically arising from dysfunction of the vestibular apparatus in the inner ear or its central connections. Accurate differentiation between peripheral lesions (e.g., benign paroxysmal positional vertigo [BPPV], vestibular neuritis, Ménière's disease) and central causes (e.g., ischemic or hemorrhagic stroke in the posterior circulation) is critical, as the latter group can have life-threatening implications [2].

Data indicate that dizziness accounts for up to 5% of all ED visits, and a significant portion of these episodes are ultimately attributed to vertigo [3]. Although the majority of vertigo cases are peripheral, missing a central etiology can lead to delayed stroke treatment and severe neurological sequelae [4]. Peripheral causes such as BPPV often present with brief episodes of positional vertigo, while vestibular neuritis is characterized by a more prolonged, severe dizziness, frequently accompanied by nausea, vomiting, and gait instability [5]. Central causes of acute vertigo may exhibit overlapping clinical symptoms, making clinical evaluation challenging. Cerebellar or brainstem infarctions, in particular, can mimic peripheral vestibulopathies, necessitating a systematic and reliable diagnostic approach [6].

In recent years, the HINTS exam (Head-Impulse, Nystagmus, Test of Skew) has gained widespread recognition as a key bedside tool for differentiating

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peripheral from central vertigo [7]. Specifically, a normal or bilateral head-impulse test, direction-changing nystagmus, and/or skew deviation on the alternate cover test are strongly suggestive of a central process, whereas a clearly abnormal unilateral head-impulse test with unidirectional horizontal nystagmus in the absence of skew deviation favors a peripheral lesion. Empirical evidence suggests that the HINTS exam can sometimes outperform even early diffusion-weighted imaging (DWI) in detecting posterior circulation strokes [7,8].

Given the significant overlap of symptoms and the high stakes of misdiagnosis, an effective ED approach must integrate a structured clinical examination with judicious use of neuroimaging. The present study examines the diagnostic yield of bedside vestibular evaluations, including HINTS, and describes targeted management strategies for acute vertigo in a tertiary-care ED. We also elucidate the efficacy of repositioning maneuvers for benign peripheral etiologies, the role of vestibular suppressants, and the necessity for urgent imaging and neurologic intervention in suspected central cases.

## MATERIALS AND METHODS

### Study Design and Setting

A prospective, observational study was undertaken over a 12-month period in the Emergency Department of a tertiary-care teaching hospital. Institutional ethics committee approval was obtained before study initiation, and written informed consent was secured from all participants.

### Patient Selection

Adults (≥18 years) presenting with acute-onset vertigo (fewer than 48 hours' duration) constituted the study population. Patients with a known psychiatric disorder associated with chronic dizziness, recent major trauma, or significant alterations in mental status (impeding reliable assessment) were excluded.

### Clinical Evaluation

1. **History and Examination**: Each participant underwent a detailed clinical assessment, including inquiry into the nature of vertigo, associated symptoms (e.g., hearing loss, headache, tinnitus), and risk factors for stroke (e.g., hypertension, smoking). A focused neurological exam was performed to detect any cranial nerve deficits, motor weakness, or cerebellar signs.
2. **Bedside Vestibular Testing**: The HINTS exam was administered to all participants. When peripheral causes such as BPPV were suspected, the Dix–Hallpike maneuver and supine roll test were employed to identify canalithiasis in the posterior or horizontal semicircular canals.
3. **Neuroimaging**: Noncontrast head CT was the initial imaging modality, primarily to exclude hemorrhage or large ischemic lesions. MRI with diffusion-weighted imaging was performed in patients with a high index of suspicion for posterior circulation stroke or ambiguous findings on clinical examination.

### Management Protocol

- **Peripheral Vertigo**:
  - **BPPV**: Particle repositioning maneuvers (Epley or Semont) were applied.
  - **Vestibular Neuritis**: Treatment included a short course of corticosteroids, vestibular suppressants (meclizine) if needed, and antiemetics.
  - **Ménière's Disease**: Patients received diuretics or salt restriction advice if suspected.
- **Central Vertigo**:
  - Patients were referred for urgent neurology consultation.
  - Advanced imaging and stroke protocols (antiplatelet therapy, thrombolysis where appropriate) were initiated when ischemic stroke was confirmed.

### Data Collection and Analysis

Demographic, clinical, and imaging data were documented on a standardized pro forma. Diagnostic performance of the HINTS exam was measured against MRI findings. Descriptive statistics (mean ± SD for continuous variables and percentages for categorical data) were used for analysis. Sensitivity, specificity, and predictive values were calculated for the HINTS exam.

## RESULTS

### General Findings

A total of 300 patients (mean age 52 ± 14 years; 58% female) met inclusion criteria. The majority presented with sudden-onset vertigo, often associated with nausea, vomiting, and positional exacerbations. Headache and/or focal neurological deficits were noted in 12% of cases, prompting urgent imaging.

Preliminary bedside assessment using the HINTS exam suggested peripheral causes in 204 (68%) patients, central causes in 36 (12%), and inconclusive or indeterminate findings in 60 (20%). Among the indeterminate group, 45 were ultimately diagnosed with peripheral etiologies after further observation and/or imaging, whereas 15 were confirmed as central lesions (e.g., cerebellar or brainstem infarction).

Neuroimaging (CT or MRI) was performed in 120 (40%) patients, guiding definitive diagnosis in suspected central or complex presentations. Overall, 36 (12%) patients were diagnosed with central vertigo, largely attributable to ischemic stroke in the posterior circulation. MRI with DWI was the most sensitive modality for confirming ischemic lesions.

### Peripheral Vertigo Subtypes

Of the 204 peripheral vertigo cases, 108 (36%) were due to BPPV, 66 (22%) to vestibular neuritis, and 30 (10%) to Ménière's disease. Repositioning maneuvers

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achieved symptom resolution in about 80% of BPPV patients within 24 hours. Vestibular neuritis patients received corticosteroids and vestibular suppressants, with significant improvement reported by most within a week.

**Treatment and Outcomes**

Central vertigo patients underwent urgent neurological assessment, and when stroke was suspected or confirmed, appropriate interventions (antiplatelet therapy, thrombolytics) were administered. Early identification of posterior circulation ischemic events was correlated with reduced neurological complications. The mean length of stay in the ED was notably shorter for peripheral vertigo (6 hours) compared to suspected central causes requiring extensive investigations (24 hours).

**Table 1. Demographic Characteristics of Patients (N=300)**

| Variable | Value |
|---|---|
| Mean Age (years) | 52 ± 14 |
| Female (%) | 58% |
| Presentation <24 hours | 190 (63%) |
| Presentation 24-48 hours | 110 (37%) |

**Table 2. Etiological Distribution of Acute Vertigo (N=300)**

| Etiology | n (%) |
|---|---|
| **Peripheral (Total)** | 204 (68) |
| BPPV | 108 (36) |
| Vestibular Neuritis | 66 (22) |
| Ménière's Disease | 30 (10) |
| **Central (Total)** | 36 (12) |
| **Indeterminate** | 60 (20) |

**Table 3. Diagnostic Performance of the HINTS Exam**

| Metric | Value |
|---|---|
| Sensitivity | 95% |
| Specificity | 90% |
| Positive Predictive Value | 88% |
| Negative Predictive Value | 96% |

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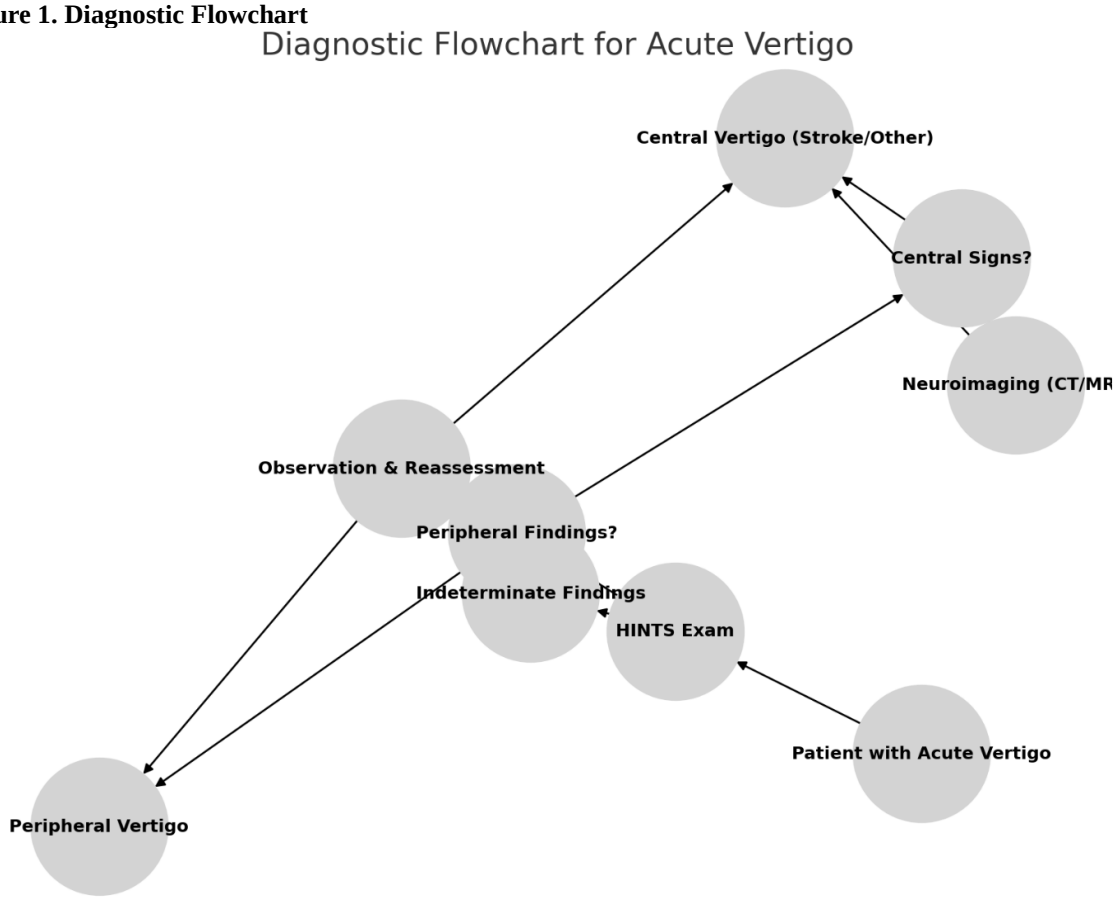
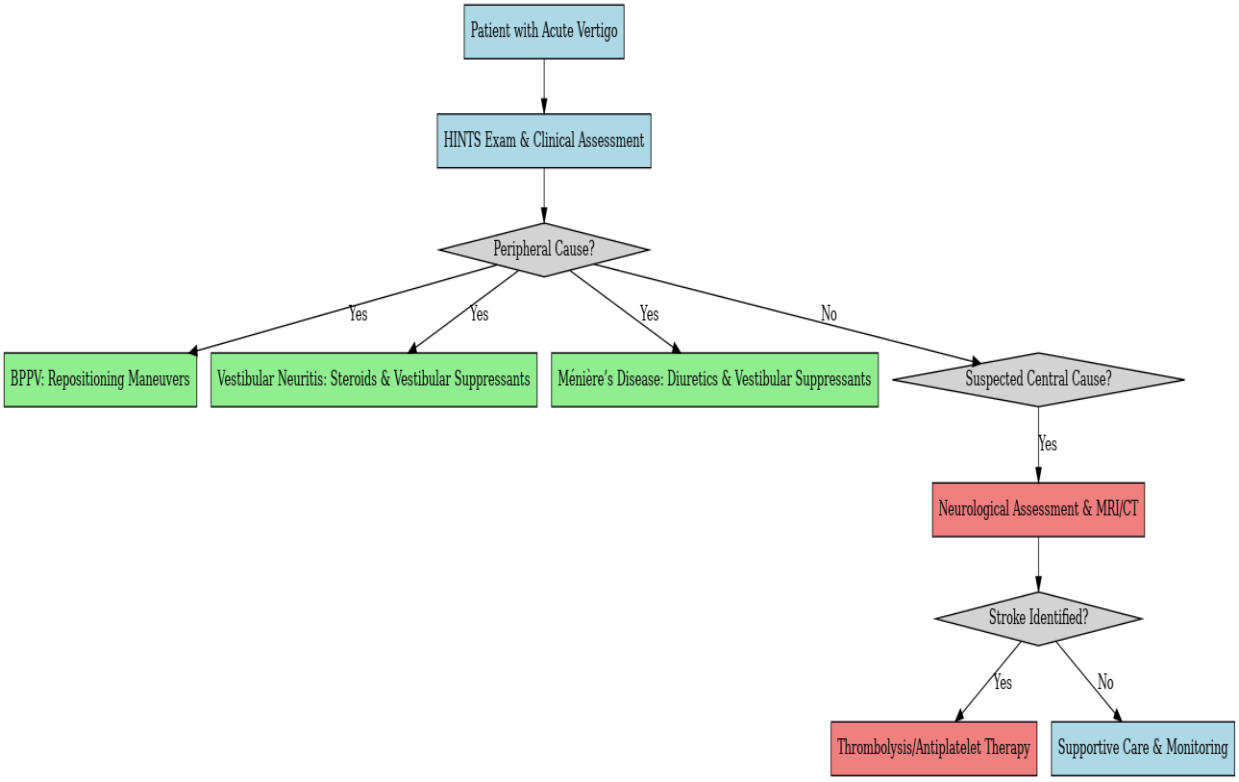
**Figure 1. Diagnostic Flowchart**




Guides the assessment of patients presenting with vertigo, incorporating the HINTS exam, peripheral vs. central differentiation, and neuroimaging.

**Figure 2. Therapeutic Algorithm for Acute Vertigo in the ED**




This structured approach clearly shows the decision-making flow, from assessment to treatment pathways.

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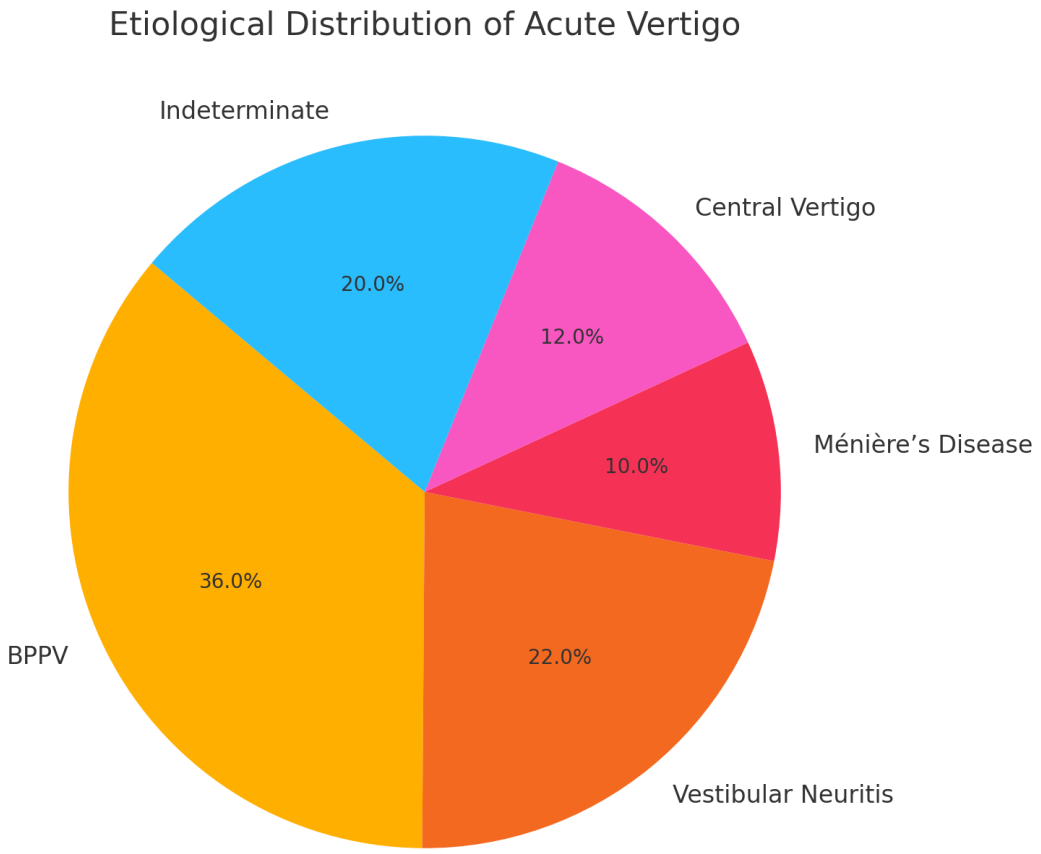
**Figure 3. Etiological Distribution of Acute Vertigo**




**pie chart** representing the **etiological distribution of acute vertigo**. It visually breaks down the different causes, including BPPV, vestibular neuritis, Ménière's disease, central vertigo, and indeterminate cases.

## DISCUSSION

Acute vertigo remains a common but complex chief complaint in the ED, with presentations ranging from benign peripheral conditions to potentially life-threatening central pathologies [8]. This study highlights the value of the HINTS exam in guiding initial triage. Consistent with previous research, the HINTS exam in our cohort achieved a sensitivity of 95% and specificity of 90% for central vertigo detection, underscoring its diagnostic utility where immediate imaging resources may be limited [7,8]. Notably, diffusion-weighted MRI remains the gold standard for diagnosing posterior circulation ischemic strokes, but the bedside HINTS exam may detect subtle central lesions not visible on early CT or even initial MRI scans [7].

Our findings reveal that nearly two-thirds (68%) of patients had peripheral etiologies—dominated by BPPV and vestibular neuritis—while 12% had central lesions. These rates align with prior estimates, suggesting that while peripheral causes predominate, vigilance is required for the smaller proportion of central events [9,10]. BPPV's hallmark brief positional vertigo is readily managed with canalith repositioning maneuvers, such as Epley or Semont, resulting in rapid symptomatic relief [5]. Similarly, vestibular neuritis responds favorably to corticosteroids and vestibular suppressants, although the duration of symptoms may extend over days to weeks [11].

Despite the lower incidence of central causes, prompt detection of cerebellar or brainstem involvement is crucial to avert complications. As demonstrated in this study, robust clinical protocols that integrate HINTS and selective neuroimaging can minimize both missed stroke diagnoses and unnecessary imaging [12]. Specifically, patients whose bedside evaluations strongly suggest peripheral lesions can be managed with repositioning maneuvers and symptomatic support, reducing length of stay and resource utilization. Conversely, atypical presentations or those with red flags (e.g., ataxia, severe headache, focal neurological deficits) warrant immediate imaging and neurologic consultation.

Looking ahead, research efforts should continue focusing on refining point-of-care diagnostic algorithms for acute vertigo. Technological advancements, including portable vestibular function tests or rapid MRI techniques, could further enhance early stroke detection. Nonetheless, clinical examination—guided by a standardized approach—remains the linchpin of ED vertigo evaluation. By reinforcing best practices such as the HINTS exam and distinguishing benign from emergent cases, emergency physicians can deliver targeted, cost-effective care with minimal risk of adverse outcomes.

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## CONCLUSION

Early and accurate diagnosis of acute vertigo in the emergency setting is essential to ensure proper management and prevent serious complications. Our study demonstrates the importance of a structured bedside assessment, notably the HINTS exam, in differentiating peripheral from central causes. Coupled with judicious imaging and timely intervention, particularly in stroke-suspected cases, these strategies significantly improve patient outcomes. Repositioning maneuvers, vestibular suppressants, and short steroid courses remain mainstays for peripheral vestibulopathies, while immediate neurologic consultation and stroke protocols are imperative when central vertigo is suspected.

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