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Original Research Article

EVALUATION OF PERIPHERAL VERTIGO: MANAGEMENT AND PROGNOSIS

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Abstract

Background: Peripheral vertigo can result from various causes, among which Benign peripheral paroxysmalvertigo (BPPV) is most common. Diagnosis of vertigo is usually made by a good clinical history, neurological, otological examination and radiological investigations. Video-nystagmography (VNG) tests are most accurate among all. Treatment consists of medical management along with various adaptation exercises according involved canal.The aim is to study the evaluation andprognosis of peripheral vertigo.

Methods: This is a prospective study involving patients with vertigo. The study had been conducted between Jun-2018 and June-2020. 100 patients were included and all of them were diagnosed with help of Video-nystagmography and treated with medications and different canalolith repositioning maneuvers.

Results: The cause of vertigo in 45% patients was Benign peripheral paroxysmalvertigo (BPPV). All the patients were diagnosed via Video-nystagmography (VNG) and Treated with canalolith repositioning maneuvers applied according to the involved canal.Migrainous vertigo proven to be second most common causes-23%. Prognosis is best in BPPV butmigrainous vertigo and vestibulopathy have poor prognosis with more recurrence.

Conclusions: Accurate diagnosis using VNG along with other investigations gives accurate knowledge about nature and cause of disease that helps in choosing particular treatment and gives chances of better prognosis with minimum follow ups.

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Keywords: Peripheral vertigo, benign peripheral paroxysmalvertigo (BPPV), video-nystagmography,canalolith repositioning maneuvers

Introduction

The International Classification of Diseases defines vertigo as a feeling of movement, a sensation as if the external world were revolving around the patient (objective vertigo) or as if he himself were revolving in space (subjective vertigo)[1].This study evaluates the vertigo patients based on history, examination and relevant investigations to establish the aetiology for the vertigo. A complication in the issue of Balance is because of integration of various systems and areas of the brain and hence the difficulty in diagnosis as well. Various studies have been done to establish the rationale behind various investigations but there is still no single Gold Standard or Guidelines to the investigate or to interpret results[2]. Clinical Examination and History remain the uncrowned Gold Standard for diagnosing Vertigo aetiology. This is a study to establish the importance of Video-Nystagmography as an investigation in persons with vertigo and its significance in contributing to diagnosis of Vertigo[3].

VNG addresses the functionality of each ear via a series of tests to find whether a vestibular disease is cause of a balance problem or not. It can differentiate between a central and a peripheral vestibular lesion, and, if peripheral, it differentiate between unilateral and bilateral vestibular loss[4].

Treatment for vertigo depends on the cause and severity of your symptoms. During a vertigo attack, lying still in a quiet, darkened room may help to ease any symptoms of nausea and reduce the sensation of spinning. Like vestibular neuronitis, benign paroxysmal positional vertigo (BPPV) often clears up without treatment after several weeks or months[5]. It's thought that the small fragments of debris in the ear canal that cause vertigo either dissolve or become lodged in a place where they no longer cause symptoms. BPPV can sometimes return and can be treated using various maneuvers. In people with Ménierè's disease, management has been challenging due to recurring vertigo episodes. Long term management may include dietary changes (low salt), medications (betahistine, steroids) and/or ablative therapy (e.g. intra-tympanic gentamicin administered to the affected ear). Vestibular rehabilitation (VR) involves carrying out a special programme of exercises that encourage your brain to adapt to the abnormal messages sent from your ears. VR in the form of appropriate movements and sensory exposure is currently the standard of care for patients with peripheral vestibular disorders regardless of age and symptom duration[6].

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Materials and Methods

This is a prospective study involving patients with vertigo. The study had been conducted between Jun-2018 and June-2020. Hundred (100) patients were included and all of them were diagnosed with help of Video-nystagmography and treated with medications and different canalolith repositioning maneuvers.

Inclusion criteria

Patients attending the ENT OPD with the chief complaint of Vertigo >15 years of age were included in the study.

Exclusion criteria

1. Patient of vertigo with neurological/cardiovascular/endocrine/hematologic/psychological disease.
2. Patients not willing to participate in the study.

Evaluation of the patient:

1. **The vestibular physical examination:** Begins with a thorough history as careful characterization of the patient's symptoms with knowledge of the various disease entities allows formulation of a differential diagnosis along with close attention to the patient's gait, use of any assistive devices (e.g., walker or cane) or glasses, and any signs of central neurologic disorder orders, such as a previous stroke or brain injury. Vital signs should be reviewed with particular attention to orthostatic blood pressures.
2. **The neurologic examination:** Includes evaluation of mental status, cranial nerves, motor and sensory systems, coordination and other cerebellar testing, Romberg testing, and assessment of gait.
3. **The oculomotor system:** To detect the presence of characteristic eye movement abnormalities suggestive of either central or peripheral vestibular system dysfunction. The assessment of the presence of any nystagmus, alignment and range of movement of eyes, involuntary saccades, vergence and pursuit eye movements.
4. **The Otologic (Ear) examination:** Should be done by otoscope/endoscope and tuning forks (256,512,1024 Hz).The normal landmarks of the tympanic membrane, middle ear and ossicular chain should be identified. If normal landmarks are obscured, infection, middle ear effusion, perforationor cholesteatoma should be ruled out.

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5. **The neurotologic examination:** Considered to be essential for a full examination include search for spontaneous nystagmus with eyes open in the dark, post-head shaking nystagmus, bedside vestibulo-ocular reflex (VOR) tests, including the head thrust/impulse test and dynamic visual acuity, Dix-Hallpike test and Romberg testing.
6. **Oculography in Vestibulometry:**Recent Technique which is used for documenting quantitatively and qualitatively different types of eye movements, Includes Video-nystagmography (VNG).

VNG machine set up

1. **Room:** The (8*10) feet room is adequate with adjustable bright lights.
2. **Patient's position:** The patient should be placed in the middle of the room in 2 feet by 6.5 feet table about 36 inches in height with an adjustable system such that the waist upwards the head end can be elevated by 30 degrees. The computer has a configuration and small box of VNG machine with goggles that is attached to a special video graphics card inserted in the computer, an air/water caloric irrigator and wash basin if possible.
3. **Visual stimulus:** Two types of visual stimuli for the oculomotor tests are available. One in which the visual stimuli are projected on the wall through a ceiling mounted projector and another type in which a light bar is used for visual stimulation. Projector/light bar should preferably be placed above the patient's head if possible mounted on the ceiling, the patient should be placed at least 1.5 meter away from the projected image and that image should be covering the entire visual field of the patient.

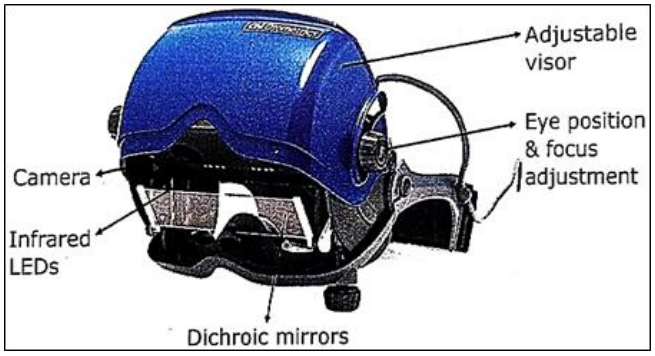

Fig1: The VNG goggles

The goggles contain an infrared video camera-a sophisticated version of the infrared cameras used in security systems), some lenses inside the camera, mirrors and a source of illumination to illuminate the eyes such that a distinct videograph of the eye movements can be obtained. The goggles have a cover or a visor which can completely cover the eyes and prevent any

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ambient light from outside entering the eyes. This is required to ensure that the eyes cannot see anything and are in complete darkness. Whenever there is an ambient light or any lighted object which the eyes can see, the eyes fixate at the visualized object and this reduces or even sometimes totally abolishes many of the abnormal eye movements that the clinician wants to document by VNG.

- VNG measures the integrity of vestibulo-ocular reflex:

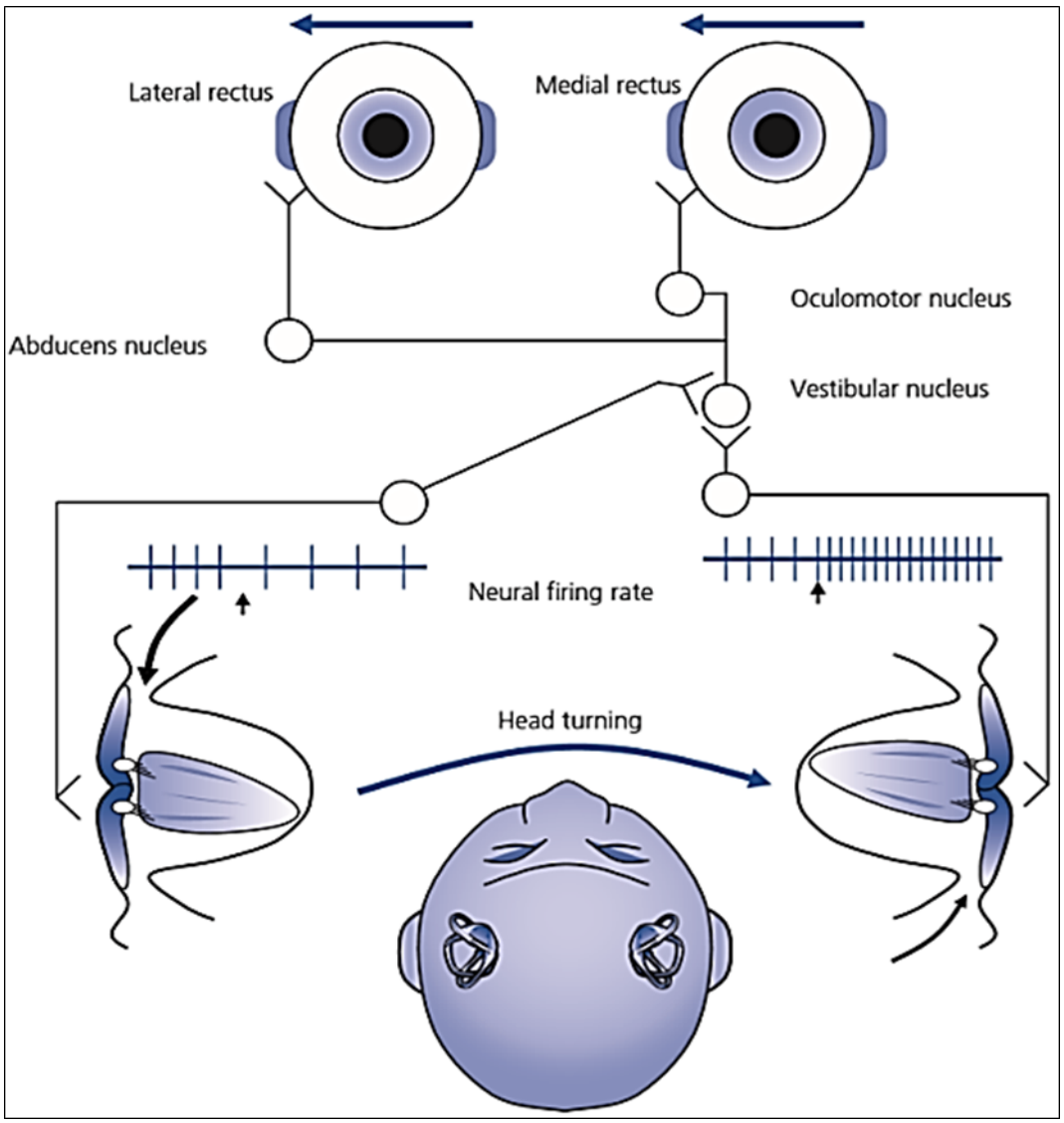

Fig2: VOR reflex pathway

VNG Tests

1.Spontaneous nystagmus

- Patients keep their head steady, the maintain their eye position in primary and lateral eye positions (30 degrees from centre) with and without fixation on a visual target.

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- Nystagmus observed in the absence of head or body motion is called spontaneous nystagmus. Visual fixation usually suppresses the nystagmus produced by a peripheral vestibular deficit, but may be impaired with medicinal, alcohol or recreational drug use or if the patient has ocular muscle fatigue, reduced visual acuity or a central vestibular dysfunction.

2. Smooth pursuit

- A subject is asked to visually track a target as it moves from side to side in the horizontal plane. As with saccadic movement and optokinetic nystagmus (OKN), the visual target may be either projected onto a screen or on a liquid crystal display (LCD).
- The smooth pursuit pathway stabilises a moving target on the fovea for velocities less than 60 degrees per second or with 1 Hz periodicity. At velocities greater than this, intrusive saccades may be introduced.

3.Saccades

- Saccades move the eye rapidly between points and are recorded by asking a subject to visually track a target as it is randomly presented in the horizontal or vertical plane (± 20 degrees from primary position, horizontally or vertically). Velocity, latency and accuracy are measured.
- Saccade velocity is not affected substantially by age or gender. Saccades are either voluntary or involuntary. Voluntary saccades occur in response to flashing or moving stimuli, or a remembered target on the peripheral retina. Involuntary saccades form the fast phase of nystagmus.

4.Optokinetic nystagmus

- For optokinetic testing, the patient tracks multiple stimuli. These may take the form of stripes on a rotating drum or a stream of lighted dots across a light bar or the field of an oculomotor stimulator. Stimuli are moved at a rate of 300, 400or 600 per second in each direction. Eye movements that are generated by moving field resemble nystagmus. The clinician primarily evaluates symmetry of the response.

5.Gaze holding test

- The patient is asked to look at a point 30 degree away from the midline and any nystagmus is looked for in the VNG tracing. Care must always be taken to ensure that the deviation of the eyes during the test is not greater than 30 degree away from the midline. If the test for gaze nystagmus is done with eyes deviated more than 30 degrees away from the midline, a nystagmus may sometimes appear. ‘This is called physiological end point

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nystagmus, and it is clinically of no pathological significance.

6. Bithermal caloric testing

- Warm and cold water at 30degrees and 44degrees centigrade are used to irrigate the ear through the EAC. This warm/cold water in turn changes the temperature of the middle ear air through an intact tympanic membrane and convection currents are setup in the endolymph of the horizontal semicircular canal as it is closest to the middle ear.
- If warm water is injected into the right ear, then the right horizontal SCC, the endolymph and hence the hair cells move utriculo-petally and produce an increase in the rate of discharge. Now the right labyrinthine receptors are sending out more stronger and higher frequency impulses than the left. This imbalance is read by both the vestibular nuclei and travels via the MLF to both the oculomotor nuclei. The contralateral lateral rectus muscle (Left in this case) and the ipsilateral medial rectus muscle are activated first leading to s slow deviation of the eyes to the left. This forms the slow phase of the vestibular nystagmus. The conjugate movements of the eyes are maintained by the B/L connections of the MLF and the internuclear connections at the level of oculomotor, trochlear and abducent nuclei. These ensure the coordinated eye movements.

Results

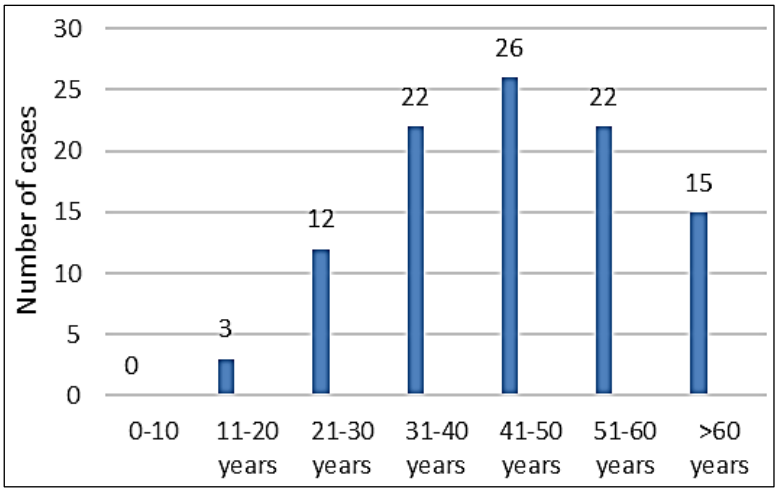

Fig1: Age distribution of study population

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Table 1: Peripheral causes of vertigo

Sr. No.	Causes	Number of cases			Percentage (%)
		Male	Female	Total	
1	BPPV	18	27	45	45
2	Vestibular Migraine	12	11	23	23
3	Meniere's Disease	3	12	15	15
4	Vestibular Neuritis	8	2	10	10
5	Vestibular Labyrinthitis	3	2	5	5
6	Vestibulopathy (Ototoxicity	2	0	2	2

Table 2: V.N.G. Tests and Results

Test	Present		Absent
Spontaneous nystagmus	77 patients		23 patients
	With visual fixation		
	Suppression or Reversal	No change (Indicative of central lesion)	
	77	-	
Smooth pursuit	Normal Gain Normal Phase	Decreased Gain	-
	97	3 (Due to low vision)	
Saccades	Normal Latency Normal Velocity	Slowed velocity & Prolonged latency	
	95	5 (Due to inattention & head movements)	
Gaze test	No nystagmus in right or left 30° lateral position of gaze	Physiological end point nystagmus	
	89	11	

Treatment

1.BPPV: Treatment consists of repositioning maneuvers. There is no role of any medicine.

The following maneuvers were applied according to the involved semicircular canal:

- For P- BPPV:

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1. Epley's maneuver

- Patients with positional nystagmus-90% complete recovery rate.
- Patients without positional nystagmus-60% complete recovery rate and a 6% persistence of symptoms.

2. Semont maneuver

Aim: To dislodge the otoconia from the cupula and move them out of the posterior semicircular canal into the vestibule where they are harmless.

Effectiveness: Resolution of symptoms in 92% of patients treated once or several times with this manoeuvre(22).

3. Brandt daroff exercise

Effectiveness:9 out of 42 patients experienced complete relief from BPPV within 3-14 days, the exception being one patient who had aperilymphatic fistula.

- For A-BPPV and H-BPPV:

Table 3: For H-BPPV and A-BPPV

Test	Total Number of patients	Improvement (%)		
		7thDay	15thday	1 month
Barbeque roll over	5	3 patients-90%	2 patients-95%	All patients improved
Modified Epley's maneuver	3	2 patients-70%	2 patients-95%	All patients improved

Table 4: Peripheral causes and treatment results (Other diseases)

Disease	Given treatment	Improvement		
Vestibular migraine	1)Medicines Ex. Triptans 2)Physiotherapy	70% in 70 patients	80% in 15 patients	100% in all patients
Meniere's disease	1)Diet restriction 2) Medicines Ex. diuretics	87% in 13 patients		
	3) Intra-tympanic inj. of Gentamycin 4) Anti-emetics	13% in 2 patients		

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Vestibular neuritis	Iv fluids+ Steroids+ Antihistamines	50% in 7- 10 days		
	Vestibular rehabilitation	All patients		
Vestibular labyrinthitis	Topical/systemic Antibiotics+intravenous steroids+Betahistine+ iv fluids	7^{th} day	15^{th} day	1 month
		40% in 2 patients	60% in 3 patients	all patients
Vestibulopathy	Withdrawal of ototoxic drugs + betahistine	40% in 2 patients	60% in 3 patients	90% in all patients

Discussion

Peripheral vertigo is more common as this is a similar observation quoted by Dr. Gurumani (2013).For instance, Vestibular migraine is being classified as a Peripheral vestibular lesion in studies by Dr. Gurumani (2013)[7]. History is more important than investigations in the diagnosis of certain conditions. For example, a history of vertiginous sensation more in the lying down position or more at night-all point more towards a peripheral lesion. In fact, vertigo while turning in bed virtually stamps the diagnosis of BPPV[8]. Also, nausea and vomiting are non-specifically associated with vertigo. BPPV was the most common diagnosis as in all studies. In my study the most common diagnosis was of BPPV (45%) which is very similar to from the studies by Gurumani (2013), Dipjyoti (2011) and Dr. Burman all of which quote around 40%[7,10,11].The Next most common diagnosis was Vestibular migraine (23%). In the other studies, Dr. Gurumani (2013) says the incidence as 5% and Dr. Dipjyoti gives an incidence of 14%. In these patients, there was a definitive history of Headache associated with the vertigo and reliefwith medication.The VNG findings of some of these patients were not normal however. Neuhauser H study showed the prevalence of migrainous vertigo was 7% in the dizziness clinic groupand 9% in the migraine clinic group. Meniere's disease which is supposed to be the commonest peripheral vestibular disorder (Mawson and Ludman 1979) is less commonly seen in this study 15 (15%) cases[10]. This figure is near to a study done by Deka (1985) and Debasish Burman (10.5%).We diagnosed them on the basis of Diagnostic criteria of Meniere's Disease.

All the 45 cases of BPPV fulfil all the diagnostic criteria for BPPV and Dix Hallpick's test was positive in all the BPPV patients. Among the 23 patients of Migrainous vertigo, 21 patients fulfil the criteria for definite migrainous vertigo, 2 patients were probable Migrainous vertigo[11]. In this study the bedside tests were not useful to identify Migrainous vertigo. Labyrinthitis composed of 5 (5%) of all patients and vertigo was the predominant complaint

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in all cases. According to Debasish Burman labyrinthitis was 7.4% of all cases.

There were five patients who complained of episodic vertigo very similar to that of BPPV, but the DHT was negative. There was no characteristic rotator nystagmus observed, however these patients complained of dizziness in the Characteristic Dix Hallpike position. Furthermore, these individuals also had a great relief from symptoms on performing the Epley's maneuver. Similar cases of BPPV were also reported in Japan by Dr. Buki in his article[12].

Validation of the VNG

VNG is a simple, non-invasive and quick investigation in the armamentarium of otorhinologists. Although it is a more sensitive test for peripheral vestibular disorders, Rotational chair testing has a specificity of only 54% compared with the 86% specificity of VNG [13]. Both tests are therefore complimentary and should be used in the diagnosis of peripheral vestibular dysfunction. But as per my study, sensitivity & specificity of caloric test for diagnosing Central lesions is very high. Hence VNG is more useful as an investigation in patients with a central cause for their vertigo especially if no lesion is detectable on Imaging[1]. However, another study has said that VNG remains a more useful investigation in Vertigo patients than MRI by stating that Video-nystagmography contributed to establishment of a diagnosis in 53/100 patients (53 per cent), whereas magnetic resonance imaging did the same in four of 100 patients (3.9 per cent)[15]. Further the sensitivity and specificity of a VNG is supposed to be more than that of ENG since it can detect and record even Torsional components of the nystagmus. If cost is not a constraint, it is always useful to prefer a VNG system than an ENG machine[16].

Conclusion

1. The relevance of this investigation is undoubtedly proven in the cases where there were no organic lesion to diagnose and yet Butterfly code and VNG showed a positive findings. In these cases, undoubtedly there is no alternative to substitute the VNG.
2. Even in patients with organic lesions not yet diagnosed, the VNG has a definitive role in the diagnosis.
3. It is definitely possible to classify a lesion to a central or peripheral pathology in patients with vertigo. And in patients with central pathology (in cases within its scope), it is also possible to localize these lesions to one side or the other and also to certain specific areas in the brain that correspond to the VOR pathways using the VNG.

4. Also, in patients with a peripheral lesion, the VNG is of lesser but definitive value. This can be especially inferred in those cases of U/L or B/L Meniere's disease which may otherwise have normal findings and in cases of U/L or B/L Vestibulopathy where there are no overt signs in the chronic/recovery phase due to ongoing vestibular rehabilitation.
5. The importance of having this investigation in the Emergency Room Setup has also been emphasized. Thus, this is one investigation which in the hands of the correct person can be extremely informative.

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