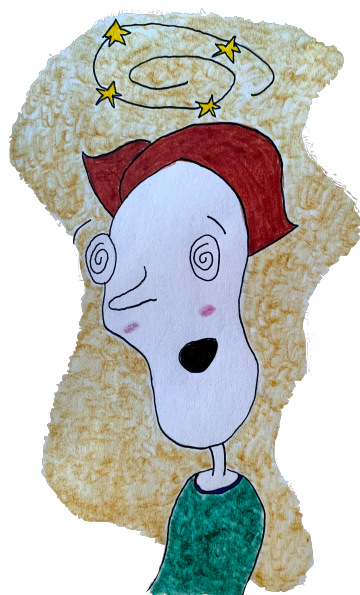


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Graduate thesis in Medical studies (CMED)
Supervisor: Lars Petter Bache-Wiig Bjørnsen
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Illustrasjon av Viel N.Carlsen

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Faculty of Medicine and Health Sciences

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Abbreviations

ED = Emergency department

EP = Emergency Physicians

EQS = Extend Quality System

ESS = Emergency Symptoms and Signs

EPR = Electronic Patient Records

APV = Acute Peripheral Vestibulopathy

AVS = Acute Vestibular Syndrome

VN = Vestibular Neuritis

HIT = Head Impulse Test

ACS = Anterior Circulation Strokes

PCS = Posterior Circulation Strokes

DWI = Diffusion-Weighted Imaging

Abstract

Objectives: Dizziness is a common symptom presenting to the emergency department (ED). Studies have estimated that around 4% of dizziness patients in the ED were confirmed cerebrovascular cases. This study aims to describe the ED patient population in our hospital that presented with dizziness as the chief complaint for their intracerebral stroke/TIA and evaluate if an appropriate investigation was performed.

Methods: Our study population was patients admitted with dizziness or vertigo and a discharge diagnosis of stroke/TIA between 2012-2020. Multiple variables regarding anamnestic factors and clinical assessments were retrieved from physician admission notes and other notes by health care professionals relevant for the admission in the EPR.

Results: In our final study population (n=201) assessment of nystagmus was only found in 87/201 (43,3%). HINTS test was only documented in 4/84 (4,8%) of patients presenting with acute-onset persistent dizziness that later proved to be due to stroke/TIA.

Conclusion: The study shows it is difficult to implement new diagnostic tools in a department with a great workload. It emphasizes the need for further education on the performance and interpretation of the HINTS test and subsequent documentation.

Background

20% of all ischemic strokes are related to the posterior cerebral circulation (1). Anterior circulation strokes often have different symptoms than posterior (2). The prehospital triage face-arm-speech-test (F.A.S.T) score is used as a screening tool to identify patients with acute stroke in Europe, Norway included (3). This tool is less sensitive in patients with disrupted posterior circulation (4, 5). The annual report from the Norwegian Stroke Register in 2019 stated that 70% of stroke patients present with one or more of the FAST symptoms (6), indicating that more than 1 out of 4 stroke patients are not being detected by this screening tool. The most frequent symptoms of posterior circulation disruption are dizziness, unilateral limb weakness, dysarthria, headache, nausea and vomiting (7). Nausea and dizziness are common and nonspecific symptoms, making strokes in the posterior circulation especially susceptible for being overlooked or misdiagnosed (8, 9). This can lead to serious adverse consequences for patients, both in terms of the lost opportunity of treatment in the acute phase and, perhaps more severe, lack of sufficient prophylactic treatment (10).

“Dizziness” is a term often used by patients to describe symptoms (11). There are many symptoms that patients may identify as dizziness – including vertigo. Dizziness in the form of vertigo is typical for strokes in the posterior circulation. Vertigo is however a term with an inconsistent definition, with a study indicating that the word needs further definition (12). The same study showed nonetheless that the word was mostly used to indicate sensations including spinning or turning only.

In a recent study, acute dizziness accounted for 4% of the chief complaints to the Emergency Department (ED) (13). Two studies have estimated that around 4% of dizziness patients in the ED were confirmed cerebrovascular cases (14, 15). Studies have reported that around one-third of stroke/TIA presenting with dizziness, vertigo or imbalance are missed in the primary assessment in the ED (14).

Stroke with dizziness as a symptom can present as Acute Vestibular Syndrome (AVS). AVS is characterized by the acute rapid onset (over seconds to hours) of continuous vertigo (lasting > 24 hours), associated with nausea, vomiting and head motion intolerance. The term was first introduced by Hotson and Baloh in 1998 (16). Vestibular neuritis (VN) is the most common cause of AVS. Up to 25% of the patients with AVS have however ischemic stroke involving the cerebellum or brainstem (17).

The three-part bedside oculomotor examination HINTS (Head-Impulse-Nystagmus-Test of Skew) is an effective tool to distinguish between AVS of peripheral and a central, possibly life-threatening cause (18-20). A finding of either normal head impulse test to both sides, direction-changing or vertical nystagmus or skew deviation indicates a lesion in the brainstem or cerebellum. Adding hearing loss to the algorithm will help catch falsely positive HIT due to anterior inferior cerebellar artery stroke, in the literature referred to as HINTS plus (10).

As both CT and MRI can be normal in the acute phase, the importance of HINTS is stressed. A prospective study from Kattah and colleagues on 100 patients with AVS found that HINTS test was 100% sensitive and 96% specific for stroke. Initial MRI diffusion-weighted imaging had an 88% overall sensitivity (72% for lateral medullary and lateral pontine infarctions) and 100% specificity (19).

At the end of 2019, a new Extend Quality System (EQS) procedure for the assessment of patients presenting with dizziness was established in the ED of our hospital. This procedure is based on a diagnostic algorithm by Ljøstad et al published in 2019 (21). The aim of this study is to describe the ED patient population in our hospital that presented with dizziness as the chief complaint for their intracerebral stroke/TIA and evaluate if appropriate investigation was performed.

Methods

Study setting

We conducted a retrospective study of 201 stroke/TIA patients that presented with dizziness to the ED of St. Olav's Hospital, the University Hospital of Trondheim, Norway. This is the local hospital for more than 320 000 citizens and regional hospital for over 720 000 per January 2021 (22). All patient data have been systematically collected from the ED database (Akuttdatabasen, Helse-Vest IKT, Version 1.5.5., Stavanger, Norway) and electronic patient journal (DocuLive EPR, Siemens, Oslo, Norway) from 1st January 2012 to 31st December 2020. All ED patients are given an acuity level from the Rapid Emergency Triage and Treatment System (RETTTS) (23), in which decision of urgency is based on both vital parameters and chief complaint (Emergency Symptoms and Signs = ESS). Dizziness or vertigo as a symptom is categorized as ESS11. A discharge diagnosis of stroke/TIA was defined as the ICD-10 codes I60-I69, G45-G46, or H81.4 (24). A small pilot study (n=20) was conducted prior to the main study, to evaluate the availability and ensure greater accuracy of the variables.

Collection of data

We have collected data from the physician admission note in the EPR and other physician or nursing notes relevant for the admission. In cases of clinical discrepancies, the documentation of the ED clinician

has outweighed the admission note information. For data regarding risk factors, only reported background information about the patient in the admission notes has been used. Time variables of radiologic imaging and intervention treatment have been collected from other parts of the documentation during the hospital stay.

Inclusion and exclusion criteria's

Inclusion criteria are the RETTS code ESS11 at arrival in the ED, and a discharge diagnosis of stroke/TIA by one of the ICD-10 definitions.

Exclusion from the study may be caused by misdiagnosing of either coding systems. This covers cases where is no record of dizziness/vertigo in the admission note or when there is concluded with another, non-stroke diagnosis (also covering orthostatic dizziness) in the discharge note. Patients diagnosed with stroke/TIA prior to the ED arrival were also excluded. The same applies for patients assessed or diagnosed in the outpatient clinic (in advance or after admission) and for patients that were not hospitalized.

Patients under 16 years of age are referred to a separate pediatric ED, and thus not included in the study. Furthermore, patients with ENT-related disorders without the need for a broader assessment may be referred directly to a dedicated ENT specialist outside the regular ED.

Statistical analysis

Data were exported and analysed using Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) and IBM-SPSS Statistics v. 27.0 (IBM Corporation, Armonk, NY, USA). Variable-comparison has been tested with Student's T-test. A P-value of <0.05 was considered statistically significant.

Variables and definitions

In this study, the following variables were collected: Age, gender, time variables in the ED, the onset of symptoms, diagnostic and follow-up imaging, anamnestic factors (specification of dizziness, persistency, characterizing of onset, spontaneous nystagmus, nausea, vomiting), clinical assessment (difficulties walking, nystagmus, use of Frenzel goggles, truncal ataxia, Romberg, intolerance for head movement, hearing loss, NIHSS-score and Dix Hallpike's), detailed HINTS test and who performed it, risk factors and any possible interventions and radiologic findings.

Risk factors: Risk factors for stroke in our study were based on the risk factors for stroke in Norway from the Norwegian Register for Stroke (25) including hypertension, previous history of stroke/TIA, smoking

history, hyperlipidemia, and atrial fibrillation. Due to a planning error, diabetes was not included. We also included coronary artery disease (26) and antithrombotic medication (27).

Anticoagulants: We have included all types of anticoagulation and no antiplatelet drugs.

Anterior and posterior circulation stroke/TIA: We define anterior circulation stroke/TIA (ACS) as within the vascular supply of the anterior and middle cerebral artery, internal carotid artery, and their branches and perforators. Similarly, posterior circulation stroke/TIA (PCS) is within the vertebrobasilar arterial system (9). Furthermore, in diagnostic imaging-finding in the thalamus region we have included all with findings in this region – also patients with findings in other cerebral parts.

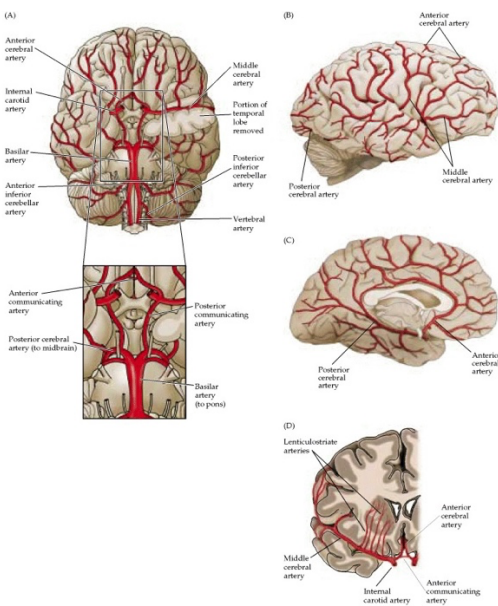


Figure 1: The major arteries of the brain (28)

Dizziness/vertigo: In our study we have included all patients with reported dizziness, not discriminating between vertiginous and non-vertiginous descriptions. The term dizziness is vague and may hold light-headedness, presyncope, disequilibrium as well as vertigo (29). Vertigo is defined as a symptom of illusory movement – either of self-motion or motion of the environment around. It can be either a sensation of spinning, swaying or tilting (30). However, we have chosen to not differ between the two due to the unreliable description of the quality of dizziness (31).

Nystagmus: Nystagmus is a rhythmic regular oscillation of the eyes (32). In our study, nystagmus was classified with a central pattern if any of the following were observed: bidirectional gaze-evoked nystagmus, vertical nystagmus in any position, or isolated torsional nystagmus (i.e., nystagmus that was

only in the rotational vector) (33). Frenzel goggle is a tool used to inhibit gaze-fixation and thus making nystagmus easier to observe (34).

Categorizing AVS

Newer guidelines for the assessment of stroke as an etiology of dizziness are partially based on patients with AVS (Acute Vestibular Syndrome) (21, 35, 36). However, there is currently no internationally established definition of AVS. Many studies have defined it as the presence of persistent vertigo for 24 hours with sudden onset and concomitant spontaneous nystagmus (including bidirectional nystagmus), nausea and/or vomiting, and either gait unsteadiness or postural instability (16, 19). Some definitions also include head motion intolerance (16, 19), describing it as dizziness typically worsening with but not triggered by movement - as with Benign Paroxysmal positional vertigo (BPPV) (10). The most comprehensive definition of AVS is in ICD-11. This definition does not include nystagmus as an absolute criterion (37), contrary to other studies highlighting nystagmus as a key component of AVS (16, 19, 21, 38). However, due to the lack of use of Frenzel goggles in our study necessary to definitely confirm the absence of nystagmus (21), we chose to include all patients except cases in which negation of nystagmus with Frenzel goggles or similar equipment was specifically documented. Furthermore, many definitions of AVS include a persistency of the symptoms for over 24 hours (16, 19, 21, 38), but due to the possibility of presentation in the ED within the first 24 hours since symptom onset, we have not established this as a criterion. In addition, definitions of AVS often specify that the patient must have vertigo (16). Due to the limitations of documentation regarding the type of dizziness, we included all patients with documented dizziness – only excluding those with negations of vertigo. Due to lack of documentation, we have also excluded nausea or vomiting as a necessary criterion, and any form of unsteadiness - represented by truncal ataxia, gait unsteadiness, or a positive Romberg.

Thus, in this study, we use the AVS-grouping regarding patients with documentation of acutely occurring persistent vertigo/dizziness.

Ethics

This data collection and study have been approved by the Regional Committee for Medical and Health Research Ethics (REK) and the Data Protection Officer at St. Olavs Hospital in 2021.

Results

Study population and selection process

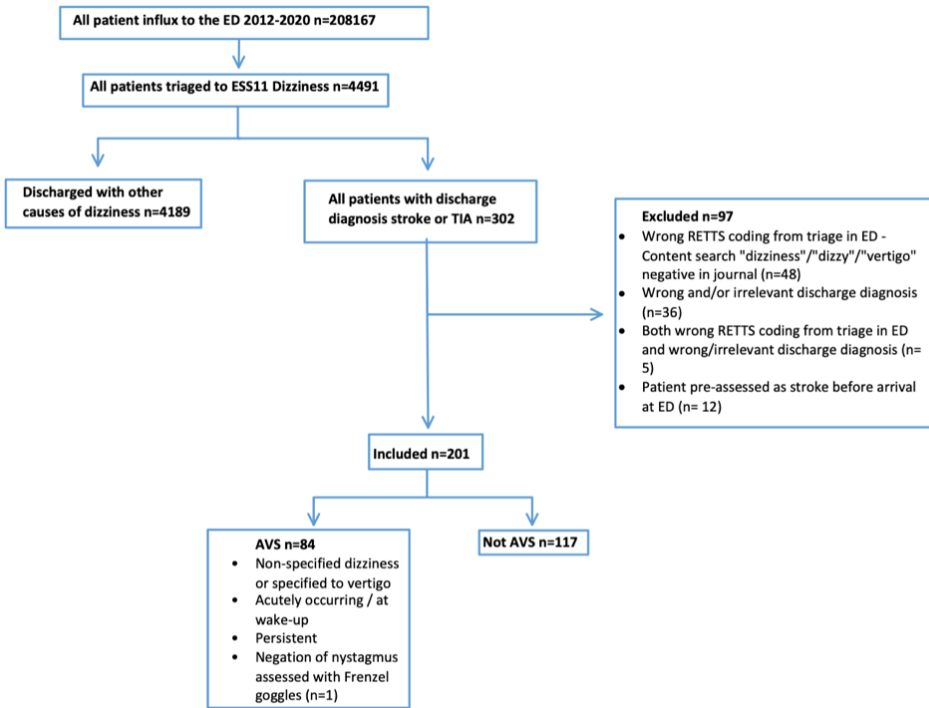


Figure 2: Flowchart of the study population. There were altogether N=14245 patients triaged to ESS12 (stroke/TIA) in the ED between 2012-2020.

Patient characteristics/background

In our final study population (n=201), patient-age ranged from 16 to 97 with a median of 73. It included 97/201 (48 %) male and 104/202 (52 %) female. The median NIHSS score of our group was 0, with a range from 0 to 18. 139/201 (69 %) had no documentation of NIHSS-score.

	Hypertension (N=201)	Smoking (N=201)	Earlier TIA/stroke (N=201)	Hyperlipidemia (N=201)	Atrial fibrillation (N=201)	Coronary artery disease (N=201)	Anticoagulant (N=201)
No or not documented	114 (56,7%)	129 (64,2%)	144 (71,6%)	175 (87,1%)	171 (85,1%)	154 (76,6%)	171 (85,1%)
Present	87 (43,3%)	72 (35,8%)	57 (28,4%)	26 (12,9%)	30 (14,9%)	47 (23,4%)	30 (14,9%)

Table 1: Risk factors in the whole study group (N=201)

Anamnestic assessments and documentation

	Acute Onset of Symptoms (N=201)	Onset >4,5 hours (N=201)	Persistent symptoms (N=201)	Dizziness specified to be vertigo** (N=201)	Nausea (N=201)	Vomiting (N=201)
Not documented	37 (18%)	60 (30%)	27 (13,4%)	67 (33,4%)	73 (36,3%)	94 (46,8%)
Present	148 (74%)	108 (54%)	111 (55,2%)	121 (60,2%)	102 (50,7%)	66 (32,8%)
Not present	16 (8%)	33 (16%)	63 (31,3%)	13 (6,5%)	26 (12,9%)	41 (20,4%)

Table 2: Demonstrates the different anamnestic variables retrieved in the study. Includes all patients (n=202) Fractions under “not documented” indicates there are no documentation of finding or negation of finding in patient-notes.

* Including n=15 wake up stroke **“Not documented” meaning the clinician having not specified further than “dizziness”. “Not present” meaning having specified the dizziness to something other than vertigo.

Of the specifications to vertigo (121/201 (60,2%)), 89/201 (44,3%) described the dizziness to movement illusion without using the word “vertigo”. There were 32/201 (15,9%) with a description of dizziness using the word vertigo.

Clinical examinations and documentation

	Intolerance For Head Movement (N=201)	New Difficulty Walking (N=201)	Truncal Ataxia (N=201)	Romberg test (N=201)	New Onset Hearing loss (N=201)	Dix Hallpike (N=201)	Nystagmus (N=201)
Not documented	147 (73,1%)	53 (26,4%)	188 (93,5%)	123 (61,2%)	173 (86,1%)	182 (90,5%)	87 (43,3%)
Present	43 (21,4%)	114 (56,7%)	7 (3,5%)	29 (14,4%)	2 (1,0%)	1 (0,5%)	41 (20,4%)
Not present	11 (5,5%)	34 (16,9%)	6 (3%)	49 (24,4)	26 (12,9)	18 (9,0%)*	73 (36,3%)**
Documented**	54 (26,9%)	148 (73,6%)	13 (6,5%)	78 (38,8%)	28 (13,9%)	19 (9,5%)	114 (56,7%)

Table 3: Demonstrates the different clinical examinations retrieved from the study – excluded those specific for HINTS test (see table 3). Includes all patients (n=202). Fractions under “not documented” indicates there are no documentation of finding or negation of finding in patient-notes. Under “Intolerance For Head Movement”, “New Difficulty Walking”, “New Occurring Hearing Loss” and “Truncal ataxia” both objective and subjective findings were accepted.

*Including one (n=1) inconclusive finding **Including three (n=3) inconclusive findings **Sum of “present” and “not present”

There were 160/201 (79,6%) with documentation of either any new difficulty walking, positive Romberg test or truncal ataxia. Frenzel goggles were not used or not documented in 200/201 (99,5%) of the patients.

	Patients classifying to AVS (N=84)	Patients not classifying to AVS (N=117)
No documentation or documented 1/3 of test	66 (78,6%)	109 (93,2%)
Full documentation	4 (4,8%)	2 (1,7%)
Partial documentation (2/3 of test)	8 (9,5%)	4 (3,4%)
Performed without full documentation*	6 (7,1%)	2 (1,7%)
Documented**	18 (21,4%)	8 (6,8%)

Table 4: Demonstrates the documentation of HINTS on all patients (N=201). *Example “negative HINTS” without further documentation **Sum of “full documentation”, “partial documentation (2/3 of test)” and “performed without full documentation”.

Patients presenting with AVS

As noted, in this study the AVS group includes patients with acutely occurring and persistent dizziness except cases with a documented negation of either vertigo or nystagmus with Frenzel goggles or similar equipment. There were 84/201 (41,8%) who qualified for this group.

	Nystagmus (n=84)	Skew (n=84)	Negative HIT (n=84)
Not documented	29 (34,5%)	79 (94,0%)	71 (84,5%)
Present	28 (33,3%) * Central pattern: 6/28 (21,4%) Peripheral pattern***: 17/28 (60,7%) Indetermined pattern: 5/28(17,9%)	0 (0,0%)	7 (8,3%)
Not present	27 (32,1%)	5 (6,0%)	6 (7,2%) **
Documented****	55 (65,5%)	5 (6,0%)	13 (15,5%)

Table 5: Documentation in the journal of examinations in the HINTS test in patients presenting with acutely occurring persistent dizziness (84/201 (41,7%). Fractions under “not documented” indicates there are no documentation of finding or negation of finding in patient notes. *Including one (n=1) inconclusive finding **including n=3 patients with an unsure finding of positive HIT ***Specified peripheral- or absence of central pattern ****sum of “present” and “not present”

Of the patients with performed HINTS in the AVS group (18/84 (21,4%), 7/18 (38,9%) had findings on HINTS indicating a central lesion for the AVS (either a probable central cause of nystagmus, negative HIT or positive skew). According to the algorithm of HINTS, the physician should in the case of peripheral finding or absence of central finding further investigate the patient with HIT and test of Skew, but this was found in only 7/17 (41,2%) and 2/17 (11,8%) of the patients, respectively.

There were 8/18 (44%) with documented assessments by physicians working in the ED, and 8/18(44%) assessed by either the neurology department or stroke unit.

Patients not presenting with AVS

Of all patients, 117/201 did not qualify to AVS; 90/117 (76,9%) presented with non-persistent dizziness, and 53/117 (45,3%) presented with a non-acute onset of their dizziness. There were 20/117 (17,1%) that had either indefinite descriptions of dizziness or a description specifically excluding vertigo.

There were 45/117 (38,5%) that had a documented finding of no nystagmus (including two patients with unsure findings). Furthermore, 14/117 (12,0%) had documented a finding of nystagmus and 58/117 (49,6%) had no documentation of nystagmus-assessment.

Of the patients with acute non-persistent symptoms (52/117 (44,4%)), Dix Hallpike's was reported on 3/52 (5,8%). These were all negative. There were 49/52 (94,2%) with no documentation of performed Dix Hallpike's.

Logistics

During the period 2012-2020 132/201 (65,7%) were admitted directly to the stroke unit. Of these, 26/201 (12,9%) were admitted to the neurology department, and 16/201 (8,0%) were admitted to the geriatric ward. The rest (27/201 (13,4%)) were admitted to other departments.

Results diagnostic imaging

There were 26/201 (12,9%) of the patients who had imaging-confirmed lesion/lesions in the anterior brain regions, 75/201 (37,3%) in the posterior brain regions, 75/201 (37,3%) had no lesion found, 14/201 (7,0%) had in both anterior and posterior, while 10/201 (5,0%) had either in the thalamus with other cerebral parts or in other, undefined parts. Among all radiologic findings (125/201, 62,2%), 26/125 (20,8%) had an anterior lesion and 75/125 (60,0%) a posterior lesion.

Of the patients with AVS, 56/84 (66,7%) had an imaging-confirmed lesion. Furthermore, 43/56 (76,8%) had a posterior finding, 5/56 (8,9%) had an anterior finding, and 5/56 (8,9%) had both an anterior and posterior finding. The rest (3/56 (5,4%)) had either in thalamus or other, undefined parts.

Treatment

In our study population of all dizzy patients in the ED that underwent a stroke/TIA, we found that 127/201 (63,2 %) were treated with ASA 300mg po or 250mg supp. Only 1 patient received thrombolysis, which was administered 59 minutes after arrival to the ED. The first NIHSS-score of the patient was 1. No one received a thrombectomy.

Discussion

This retrospective study was based on data from 201 patients presenting with dizziness to the ED at a University Hospital in Norway and discharged with a fresh diagnosis of stroke/TIA. Patient characteristics and risk factors do not differ majorly from the general stroke population of Norway (25)

Our finding of a low median NIHSS score of 0 in our study population is in line with studies demonstrating that this scoring tool does not adequately assess symptoms typical of posterior circulation stroke (4, 39, 40).

In our study, 67/201 (33,4%) of the patients had no documented specification of dizziness in their admission notes. This is in accordance with a population-based study on 1666 ED patients presenting with dizziness, which found specification by the word vertigo to be no more predictive of stroke/TIA than descriptions of dizziness (14). This emphasizes the significance of investigation of all patients with dizziness in the ED, even the less obvious stroke/TIA patients with non-specific dizziness.

Our study showed that nystagmus was not documented in 87/201 (43,3%) of all patients. This is fewer than in a study from an American ED, showing no documentation of nystagmus in 18,7% (204/1091) of visits for dizziness (41). Frenzel goggles, a tool needed for ruling out nystagmus (21) were not used or not documented in 200/201 (99,5%) of our patients. 41/201 (20,4%) had no documentation of any form of unsteadiness.

Regarding assessment of the patient group with acute onset of persistent dizziness (classified as AVS in our study), 28/84 (33,3%) were documented with nystagmus. Of these most had a peripheral pattern (17/28 (60,7%). This corresponds to previous studies showing most strokes presenting with AVS have a non-clearly central type of nystagmus (10, 19), whilst a vertical or bidirectional nystagmus rules out a peripheral cause more definitively.

In the AVS group a full HINTS examination would often be appropriate to assess the possibility of a central origin of their symptoms. However, it was performed and fully documented in only 4/84 (4,8%) of the patients. A similar finding of a low rate of HINT-examination on patients with AVS has been reported from another Norwegian hospital (42). Inevitably, this may include patients without a convincing indication for performing HINT but is nonetheless a low rate of performed HINTS.

Furthermore, when assessing nystagmus, the clinicians were not always consistent with consequent investigations. When adequately assessed for nystagmus in our AVS group with a finding of probable peripheral or absence of central cause (n=17), a total of only 7/17 (41,2%) and 2/17 (11,8%) did further

investigate the patient with HIT and Skews respectively. This does not follow the proposed algorithm (21) and may suggest a lacking implementation of this diagnostic tool in the ED.

Among the non-AVS-presenting patients (117/201 (58,2%)), we found that 8/117 (6,8%) were assessed with HINTS. This clinical practice is not recommended due to possible false-positive cases of HIT, especially in patients with positional vertigo (43). However, Ljøstad and colleagues suggest performing Dix Hallpike's on patients with acute onset episodic dizziness (21). 52/201 (25,9%) of our study population had acute onset non-persistent dizziness, and Dix Hallpike's was performed on 3/52 (5,8%) of these. Provocative maneuvers, such as Dix-Hallpike's, are not recommended on patients with AVS in the acute setting due to possible worsening of symptoms leading to a misinterpreted diagnosis (17). In our study, Dix Hallpike's was performed percentagewise on more of the patients classifying to AVS (11/84 (13,1%)), than those that did not. This could indicate a possibly coincidental diagnostic approach. Still, we have no data regarding if the patients not classifying to AVS in our study had positional vertigo – thus nuances regarding our clinician's evaluation for the relevance of Dix-Hallpike's are not presented.

Among the patients with radiologic findings, 60,0% (75/125) had a lesion in the posterior blood supply and 26/125 (20,8%) had an anterior lesion. This is in accordance with studies showing that stroke/TIA in the posterior circulation often presents with symptoms that are susceptible to being misdiagnosed or overlooked (8, 9). For instance, the established out-of-hospital FAST score (4) has been shown to not identify 40% of PCS versus 10% of ACS (4).

Overall, insufficient documentation by clinicians constitutes the greatest finding in our study. In our whole study population, 139/201 (69,2%) had no documentation of the well-established NIHSS-score. This could point to clinicians leaving the assessment out with patients presenting with non-typical stroke symptoms but could also indicate knowledge of the score's diagnostic limitation in PCS (4, 39, 40). Lacking documentation of nystagmus and unsteadiness are also central findings. Particularly a low documentation rate of a full HINTS test on patients with AVS emphasizes shortcomings in the diagnostics of our patient group.

Limitations

The retrospective approach, limited sample size and being a single-centre study is central limitations in our study. Manual registration of data may have led to errors. Lacking data through journal documentation, as with all retrospective case reviews, has also constituted a major limitation.

Furthermore, with our inclusion criteria of a discharge stroke/TIA diagnosis, we are not able to comment

on and compare the cases of dizziness that turned out to be of peripheral or undetermined causes. Thus, this study does not focus on addressing the overall issue of dizziness assessment in the ED.

Additionally, with data collection from a digital journal system not well intended for documentation of time variables, such as administration of antithrombotic medication and onset of diagnostic assessments, one can expect imprecise monitoring of the clinicians.

Our data of the performance of HINTS test does not have specific information regarding cases with patients unable to cooperate. Thus, these patients fell under the category of “not documented HINTS test”. Furthermore, in our data collection we made it a necessity that the clinician had documented at least two of the three assessments in the HINTS test. A source of error is when the clinician only reported one of these assessments and reported it as a finding of a possible central cause - because they are then reported as HINTS “not documented”.

Furthermore, we do not have specific data on the distribution of discharge diagnosis between stroke and TIA. There may be patients with no lesion found on diagnostic imaging that ultimately was diagnosed with stroke due to a convincing clinical picture. This limitation is due to unprecise discharge-diagnosis coding that we in hindsight could not use to categorize our patients in these groups.

Conclusion

Our study found that within the group of ED-patients with stroke/TIA presenting with dizziness, there is inadequate documentation in the physician notes. For instance, assessment of nystagmus was only found in 87/201 (43,3%), and the HINTS test was only documented in 4/84 (4,8%) of patients presenting with acute-onset persistent dizziness that later proved to be due to stroke/TIA. This study shows it is difficult to implement new diagnostic tools in a department with a great workload. Furthermore, it indicates the importance of ongoing improvement work in our ED to simplify the assessment, amongst others with the purchase of more Frenzel goggles. Standardized documentation templates for more consistent documentation could also be of use. To sum up, our study emphasizes the need for further education on the performance and interpretation of the HINTS test and subsequent documentation.

Conflict of interest

No conflict of interest has been declared by the authors.

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