« The European Evaluation of Vertigo scale (EEV) : a Clinical Validation Study»

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ABSTRACT

The European Evaluation of Vertigo scale (EEV) is a physician-administered questionnaire that only assesses symptoms and allows physicians to quantitatively evaluate vertigo, along with accompanying symptoms associated with a vestibular syndrome.

The reliability, responsiveness and construct, convergent and discriminant validity were assessed. Construct, convergent and discriminant validity were determined by comparing the scores on the EEV scale with those obtained using validated scales.
The reliability of the EEV scale was good (interrater reliability $r = 0.93$ for the global score, responsiveness $p < 0.01$). The correlation between day 0 scores on the EEV and SF-36 scales was satisfactory, especially with respect to the physical dimension of SF-36. On day 0, the correlations with the other scales were more widely scattered. On day 30, the correlations were much higher on day 30 after the symptoms of vertigo had regressed.

The EEV scale is therefore a validated physician-administered questionnaire capable of rating vertigo and accompanying vestibular symptoms.

Key words : Vertigo; Self-administered questionnaire; Validation; Physician-administered questionnaire.

1. INTRODUCTION

Vertigo is a subjective symptom defined as the illusion of movement (false impression of movement of the body with respect to the environment or of the environment with respect to the body). It is accompanied by an objective sign (nystagmus) and neurovegetative signs (nausea and vomiting).

Vertigo is the key symptom, albeit not the only one, of affections involving the vestibular apparatus (which includes the posterior labyrinth, the vestibular nerve, the vestibular nuclei and their central connections). Vertigo may be accompanied or replaced by motion intolerance and instability, depending on the underlying cause and the course of the vestibular syndrome. For example, a patient may not experience the marked rotational vertigo associated with Menière's disease but suffer from permanent instability that may partly regress following selective vestibular neurotomy. Instead of the inaugural rotational vertigo associated with vestibular neuritis, the patient may present with major motion intolerance leading to positional vertigo. Many patients with benign paroxysmal positional vertigo (BPPV) may suffer from repeated bouts of instability rather than positional vertigo.

For this reason, any evaluation of a dizzy patient must address all components of the vestibular syndrome : vertigo, motion intolerance, neurovegetative signs and instability.

Vertigo may benefit from drug treatment, physiotherapy or surgery, depending on the underlying cause. However, the efficacy of any treatment remains difficult to evaluate for a number of reasons :

1. The lack of any correlation between the results of vestibulometric investigations and symptoms once the vestibular compensation phase is achieved,
2. The often unpredictable course of vertigo,
3. The difference in perception of vertigo among patients and between physician and patient, with the latter being more aware of the resulting handicap, and especially 4/ the degree of disability and handicap associated with vertigo (1, 2, 3).

Indeed, Yardley *et al.* have shown that the fear of recurrences is at the root of the psychosocial handicap associated with vertigo, and that the severity of the handicap depends on the accompanying somatic anxiety (1, 2, 3). The authors stress the need for a separate evaluation of anxiety using specific scales such as the STAI-T (Spielberger's Trait Anxiety Inventory) and the HAD (Hospital Anxiety and Depression scale) and recommend the VSS (Vertigo Symptom Scale) and VHQ (Vertigo Handicap Questionnaire) scales to evaluate vertigo and its impact. Using these tools, they have demonstrated that the frequency and severity of attacks only partly or indirectly correlate with the handicap. It is the fear of experiencing vertigo rather than the actual frequency of attacks that is the source of the handicap.

Other quantitative vertigo rating scales include the "Vertigogram" designed by Arenberg in 1990 to assess the value of vestibular surgery in patients with Menière's disease (4). The "Vertigogram" measures the duration (abscissa) and frequency (ordinate) of vertigo attacks. The attacks are evaluated weekly, monthly and yearly, in order to stage vertigo into one of six categories.
This questionnaire nevertheless has several drawbacks :

1) it is based on a subjective assessment of two parameters of vertigo (frequency and duration of attacks), which may be either exaggerated or minimised by the patient depending on his or her ability to adapt to the intensity of the attacks;
2) it does not assess instability and motion intolerance, both of which are part of the vestibular syndrome and at least as serious as vertigo;

3) it requires a prolonged observation period (6 months before and 12 months after surgery) because of the unpredictable nature of Menière's disease.

Honrubia developed the "UCLA-DQ" (UCLA-Dizziness Questionnaire) which includes five items : frequency and severity of attacks, anxiety, impact of vertigo on the patient's activity and quality of life (5). These items do not explore all the aspects of the vestibular syndrome and only apply to vertigo that occurs in attacks. A validated version is not available.

Recently, Murphy and Gates developed the MD-POSI (the Meniere's Disease Patient-Oriented Severity Index) scale to evaluate the clinical status of patients with Meniere's disease (6). The MD-POSI has the advantage of differentiating between attacks and vertigo-free periods. However, it also assesses auditory symptoms, making it less valid for vestibular assessment.

Lastly, the DHI (Dizziness Handicap Inventory) scale was proposed by Jacobson in 1990 to evaluate the impact of vertigo on quality of life (7). Today, it is widely used throughout the world. It is a self-administered questionnaire consisting of 25 items in three subgroups that evaluate each of the three dimensions of the handicap : functional handicap (9 items), the emotional handicap (9 items) and physical handicap (7 items) associated with vertigo. The results of the validation study have shown a correlation between the global DHI score and the subscores for functional and emotional handicap but not between the former and the physical handicap subscore. This confirms the seriousness of the emotional impact of vertigo. Jacobson also demonstrated the lack of any correlation between the frequency of attacks and the degree of handicap, as some patients who experience permanent instability may be significantly less affected in their daily lives than patients who suffer fewer than 12 attacks per year.

It is clear from the foregoing that the various scales designed to evaluate vertigo differ in their concept from the EEV scale, and that furthermore, those scales specifically designed to measure symptoms are flawed on several points : either the scale is too restrictive because it only applies to a specific clinical situation ("Vertigogram") (4), or it is unspecific for the vestibular syndrome because it also covers somatic anxiety ("VSS") (2), associated auditory symptoms (MD-POSI scale) (6), or the handicap associated with vertigo (UCLA-DQ scale) (5).

To heighten the reliability of both the clinical and therapeutic evaluation of vertigo, a physician-administered symptom scale was developed. This scale only evaluates vertigo and associated vestibular symptoms and considers neither the frequency of vertigo or the resulting handicap. We report hereafter the results of a validation study in ENT practice.

2. MATERIALS AND METHODS

2.1 The EEV scale

The EEV scale rates vertigo and associated vestibular symptoms. This physician-administered scale consists of five equally weighted items scored from 0 to 4 on a categorical five-point scale. The following five items are considered : “Illusion of Movement”, “Duration of the Illusion”, “Motion Intolerance”, “Neurovegetative Signs”, and “Instability” (Fig.1).

The patient interview covers the day of the visit and the previous seven days. The score for each item is the mean score for the previous eight days. The global score is the sum of the scores for the five items.

2.2 Validation of the EEV scale

The validation of EEV scale was carried out in co-operation with the Institut de Recherche et d'Evaluation Médicale et Economique (IREME) [Institute for Medical and Economic Research and Evaluation] in an open, multicenter, non-randomized clinical study, conducted among ambulatory patients suffering from vertigo and requiring anti-vertigo treatment. Twenty-six ENT specialists in hospital or private practice participated in this study. The study protocol was approved by the CCPPRB (Comité Consultatif de Protection des Personnes soumises à une Recherche Biomédicale) [ethics committee] of Limoges.

2.2.1 Patients

Patients who met the following criteria could be included :

- ambulatory patients 18 or more years old,
- consulting because of vertigo (two episodes during the previous two months, including at least one during the previous week),
- requiring initiation of anti-vertigo treatment (drug treatment and/or physiotherapy),
- having given their written informed consent.

Patients with any of the following types of vertigo could not be included in the study : iatrogenic vertigo, vertigo associated with menstruation, neurological vertigo and vertigo associated with hypoglycemia.

2.2.2 Evaluation of vertigo and associated vestibular symptoms

In addition to the EEV scale, four other questionnaires were to be completed :

- A diary in which the patient recorded the following data : occurrence of vertigo, number of attacks, total duration of attacks, intensity of distress experienced during the worst attack, instability, nausea and vomiting. The diary was completed from day 0 to day 30.

- The vertigo evaluation scale recommended in 1984 by the Direction de la Pharmacie et du Médicament (DPHM*) also called “the conventional DPHM scale”. This scale collects data on the three parameters of vertigo : mean number, mean intensity and mean duration of attacks. These parameters are rated on a categorical scale of 1 to 4 where 4 is the most

severe rating (8). The conventional DPHM scale was completed by the physician on day 0, day 7 and day 30, and covered the day of the visit and the previous 7 days.

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- The functional scale of the American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS scale, or "AAO scale") is a categorical scale evaluating the impact of vertigo on the patient's activity (functional handicap) (9, 10). The scores range from 1 to 6, where "6" rates the financial compensation provided as a result of vertigo. The score "6" was not used because the investigators did not find it pertinent for this study. The AAO scale was used by the physician on day 0, day 7 and day 30, and covered the day of the visit and the previous seven days.

- The SF-36 questionnaire or "SF-36", is a generic quality-of-life scale widely used throughout the world (11). It consists of 36 items divided among eight dimensions : "Physical Functioning" (10 items), "Physical Role" (4 items), "Bodily Pain" (2 items), "General Health" (5 items), "Vitality" (4 items), "Social Functioning" (2 items), "Emotional Role" (3 items), "Mental Health" (5 items). The higher the score, the better the patient's health status. The SF-36 questionnaire was administered on days 0 and 30.

2.2.3 Metric properties to be validated

The EEV validation concerned face validity, content validity, reliability, construct, convergent and discriminant validity, responsiveness and acceptability (12, 13, 14).

Reliability was determined among clinically stable patients; Spearman's correlation coefficient between item subscores obtained at day 0 and day 7 describes the reliability of the EEV scale. As with any physician-administered questionnaire, we also investigated the interrater consistency by calculating the intra-class correlation coefficient (15, 16).

The responsiveness of the EEV scale was determined among a subgroup of patients whose clinical status improved between day 0 and day 30. The mean item subscore was calculated, as was Spearman's correlation coefficient between day 0 and day 30. Lastly, the degree of variation for item subscores was assessed by calculating the size effect (17).

To study the construct, convergent and discriminant validity of a scale means to check that it effectively measures what it is designed to measure (18). Considering the lack of any correlation between vestibulometric tests and vertigo severity, the EEV scores were compared with the scores on other validated scales that explore the same domains. The convergent or discriminant validity of the EEV scale was assessed against the patient diary, the conventional DPHM scale and the functional AAO scale. The construct validity of the EEV scale was assessed by using the SF-36.

2.2.4 Statistical tests

The statistical analysis was carried out using version 8.0 of the SPSS software. The items were considered to be discrete quantitative variables. The mean, standard deviation of the mean and quartiles were calculated. The interval between the first and third quartiles was defined as the inter-quartile interval and includes 50% of the subjects. It expresses the scatter of patient responses. Box-and-whisker plots showing the distribution of the dimensional scores were constructed for the disease stages at day 0.

The day 0 and day 7 scores and day 7 and day 30 scores were compared using the Wilcoxon test for paired variables. The convergent and discriminant validity of the EEV scale was compared with that of the other scales using Spearman's correlation coefficient. The inter-patient variance and the interrater variance necessary to determine the intra-class correlation coefficient, were calculated by two-way analysis of variance.

All statistical tests were two-tailed with an α risk at 0.05. The 95% confidence intervals were calculated.

Other statistical parameters were calculated to determine the responsiveness of the EEV scale. The size effect was calculated by dividing the difference between mean scores at day 28 and at day 0 by the standard deviation of the score at day 0. This yields a dimensionless number which serves to compare the change in score on several scales. Guyatt *et al.* report calculating the size effect using the standard deviation for the difference between mean scores at day 28 and day 0 as the denominator.

3. RESULTS

3.1 Patient characteristics

One-hundred and twenty-three patients (32 men and 91 women) were included in this study. Mean (± S.D.) age was 52.9 ± 2.5 years (median : 54.0 years). All socio-professional categories were represented.

Fifty percent of the patients had suffered from vertigo for 12 months, and 40% had suffered for more than two years. At inclusion, mean (± S.D.) time since the first attack was 40.8 ± 5.8 months. Patients most frequently suffered from the following types of vertigo : 1) benign paroxysmal positional vertigo or BPPV (n = 37; 30.1%); 2) Menière's disease (n = 34; 27.6%); 3) recurrent vertigo (n = 28; 22.8%) and 4) vestibular neuritis (n = 11; 8.9%).

3.2 Change in scores over time

Overall, scores improved between day 0 and day 7 and between day 7 and day 30, regardless of the scale used (Tables I, II, III, IV and V).
Mean global EEV score decreased from 7.224 (day 0), to 5.470 (day 7) and to 2.084 (day 30) (Table I and Fig.2).
The score for the number of attacks reported in the patient diary decreased from 8.42 (day 0) to 2.56 (day 30) (Table II).
On the DPHM scale, only the score for "mean vertigo intensity" improved; it decreased from 2.57 (day 0), to 1.79 (day 7) and to 1.28 (day 30) (Table III).
The scores for "mean duration of attacks" remained stable, and were 2.11 at day 0, 1.85 at day 7 and 1.82 at day 30. The scores for "mean number of attacks" increased, from 9.82 (day 0) to 15.02 (day 7) and to 13.10 (day 30). Mean AAO score decreased from 3.51 (day 0) to 2.58 (day 7) and to 1.74 (day 30) (Table IV).
The global SF-36 score improved from 418. (day 0) to 485 (day 30) (Table V and Fig.3). The improvement was mainly due to the dimensions that evaluate the physical impact of vertigo, such as "Physical Functioning", "Physical Role" and "Bodily Pain", whereas the "General Health" dimension remaining stable. In contrast, the dimensions that evaluate emotional impact of vertigo, such as "Vitality", "Emotional Role" and "Mental Health" showed little change ; the "Social Functioning" score improved.

3.3 Validation of the EEV scale

- *Content validity*

As the EEV scale is a clinical scale, the fact that items were selected by medical experts should guarantee the content validity of this instrument.

- *Reliability*

Reliability was measured in 45 patients whose AAO scores had not changed from day 0 to day 7 (functionally stable patients). Among these patients, four EEV item subscores (”Illusion of Movement”, “Duration of Illusion”, “Motion Intolerance” and “Instability”) as well as the global score, did not show a significant change ; ($p < 0.20$) (Table VI). A statistically significant improvement ($p < 0.05$) was found for the “Neurovegetative Signs” item.

To determine the interclass correlation for each of the EEV items, 21 videotapes of study patient interviews were shown to four ENT specialists. The correlations were 0.91 for “Illusion of Movement”, 0.58 for “Duration of the Illusion”, 0.90 for “Motion Intolerance”, 0.97 for “Neurovegetative Signs”, 0.87 for “Instability”, and 0.93 for global score. With the exception of the “Duration of Illusion” item, all the correlations were close to 1, thus demonstrating excellent interrater reproducibility.

- *Responsiveness*

EEV scale responsiveness was assessed in patients whose AAO scores improved (n= 90). All these patients had EEV item subscores and global scores that were significantly different at day 0 and day 30 ($p < 0.001$)
(Table VII).

We also assessed the responsiveness of clinical scales by calculating two statistical parameters of responsiveness : size effect and the Guyatt statistic method (Table VIII). These two parameters reflect the variation in dimensional scores between two evaluations in patients whose clinical status improves. The higher the parameter, the greater the responsiveness of the indicator. It was apparent that the responsiveness of the EEV items was considerably greater than that of the SF-36 dimensions.

- *Construct, convergent and discriminant validity*

Construct, convergent and discriminant validity of the EEV scale was determined by comparing EEV scale scores with the DPHM, AAO and SF-36 scales scores.

- **Correlations with the DPHM scale** (Table IX)

At day 0, the “Neurovegetative Signs” ($r = 0.284$) and “Instability” items ($r = 0.20$) on the EEV scale correlated with the “mean intensity of attacks” parameter on the DPHM scale. At day 7 and day 30, all the EEV items correlated with this parameter.

On day 0, day 7 and day 30, a strong and statistically significant correlation ($r > 0.40$), was observed between the EEV items and the “mean number of attacks” parameter on the DPHM scale.

On day 0, a statistically significant correlation was found between the scores for the “Illusion of Movement”, “Duration of the Illusion” and “Motion Intolerance” items on the EEV scale and the

“mean duration of attacks” parameter on the DPHM scale ; these correlations were no longer found on day 7 and day 30.

- **Correlations with the AAO scale** (Table X)

At day 0, the EEV item subscores only rarely or only weakly correlated with the AAO subscores. At day 7, the item subscores on both scales closely correlated, as did the global score (r = 0.560). At day 30, the correlations were higher yet, in particular between the global EEV and AAO scores (r = 0.810).

- **Correlations with the SF-36 scale** (Table XI)

The correlations between the five EEV items and the eight dimensions of the SF-36 are shown in Table XI. As the SF-36 questionnaire was only completed on days 0 and 30, correlation coefficients were only calculated for those time-points. At day 0, there was a statistically significant correlation between the global EEV score and the "Physical Functioning", "Bodily Pain", "Vitality" subscores on the SF-36 (r = 0,30). At day 30, all correlations, both between the global EEV score, the five EEV items and the eight SF-36 dimensions, were statistically significant, except for the "General Health" dimension.

4. DISCUSSION

The EEV scale is a new vertigo symptom rating scale which accurately inventories the components of the vestibular syndrome over a period of seven days before, and on the day of, the visit. This makes it possible to obtain a score for each of the five items on this scale (“Illusion of Movement”, “Duration of Illusion”, “Motion Intolerance”, “Neurovegetative Signs” and “Instability”), and thus rate each element of the vestibular syndrome and monitor its course.

The reliability of the scale was demonstrated in functionally stable patients. The interrater reproducibility was verified in group rating sessions. However, the wide variability of the “Duration of Illusion” item subscore is probably due to the difficulty raters had in clearly differenciating between the length of time the patient experienced illusion of movement and the total duration of the episode of vertigo. These differences in interpretation observed between experts should be improved by asking separate questions on the duration of the illusion and the duration of the episode, during the patient interview.

Responsiveness is an important metric quality, in particular when the effectiveness of symptomatic treatment needs to be evaluated. The responsiveness of the EEV scale was also demonstrated by comparison with the AAO scale. With the exception of the “Neurovegetative Signs” item, the lack of any statistically significant difference between the change in scores for the two scales demonstrated the responsiveness of the EEV scale. The lack of correlation with “Neurovegetative Signs” can probably be explained by the discontinuous nature of these symptoms during the attack and their consequently low impact on AAO scale scores.

Considering that there is no objective and quantifiable calibrator, such as for instance videonystagmography (VNG), and that central compensation largely contributes to the improvement in vertigo and related symptoms, even as the lesions persist, we used three scales to evaluate the construct, convergent and discriminant validity of the EEV scale. These scales included one physician-administered questionnaire, the DPHM scale that measures three vertigo parameters (frequency, intensity and duration of vertigo) and two self-administered questionnaires that evaluate disability (functional AAO scale) and handicap (the generic SF-36 quality-of-life scale).

The assessment of the construct, convergent and discriminant validity of the EEV scale with respect to the other scales showed that the EEV item subscores and the EEV global score correlate well with the three item subscores on the DPHM scale. Only the EEV "Neurovegetative Signs" item at days 0 and 7 showed no correlation, probably because neurovegetative signs tend to regress rapidly.

The poor correlations observed between the "mean duration of attacks" item subscore on the DPHM scale and the EEV item subscores and global scores are undoubtedly due to the fact that the EEV scale evaluates exclusively the duration of the illusion (duration of the attack), whereas the DPHM scale evaluates the complete signs and symptoms of vertigo (duration of attack and vertigo free period). Furthermore, it is difficult to assess the duration of certain types of vertigo, either because vertigo regresses rapidly, as is the case for benign paroxysmal positional vertigo, or conversely because the episode of vertigo progresses uninterruptedly over several days (vertigo associated with vestibular neuritis).

A close correlation was observed between the EEV item subscores and the AAO item subscores at day 30 ($r = 0.81$); the correlation was moderate at day 7 ($r=0.51$) and none was observed at day 0. This confirms the lack of any correlation between the intensity of the vestibular syndrome and the degree of disability, and again demonstrates the importance of differentiating between vertigo and its impact on the patient's life : indeed much depends on the individual patient history. The progressive improvement in correlations between day 0 and day 30 can be explained by the fact that the investigator could use the patient diary to complete the EEV questionnaire on days 7 and 30 and thus compare the interview data and the data recorded in the diary so as to improve the reliability of the EEV scale rating.

Close examination of the correlations between the EEV item subscores and the SF-36 dimension subscores shows significant correlations at day 0 and 30 for dimensions exploring the physical impact of vertigo but no correlation between dimensions that measure the emotional impact (Table XI). As with the AAO scale, this confirms the absence of correlation between the severity of attacks and their emotional impact, which remain specifics to each individual. Furthermore, the SF-36 quality-of-life scores at days 0 and 30 clearly bring to light the drawback of self-administered questionnaires. Indeed, although physical impairment was minimal, marked handicap was found, as shown by the comparison between the day 30 and day 0 scores on the EEV and SF-36 scales (see Table IV). This skew, especially as concerns the "General Health" dimension, is not only due to the patient's intense, persistent fear of recurrences, but also to the presence of sometimes prolonged and distressing concomitant cochlear symptoms (deafness and tinnitus). An equivalent situation was reported by Kinney in his article on the impact of Menière's disease on quality of life (19). According to Kinney, the physical dimensions of the SF-36 ("Physical Functioning", "Physical Role", "Bodily Pain") as well as the "General Health" dimension were associated with minor medical problems, whereas the SF-36 dimensions evaluating the emotional component ("Social Functioning", "Emotional Role", "Vitality") were associated with serious medical problems. The same study reported severe handicaps despite relatively mild symptoms. This is typical of vertigo-associated diseases and tends to complicate patient management.

Consequently, the good construct, convergent and discriminant validity of the EEV scale confirms that it only assesses the physical component of vertigo, to the exclusion of all other components. In contrast to the other scales used in our study, the EEV scale does not take account of the frequency of vertigo attacks, nor their impact on physical or emotional functioning or even quality of life.

5. CONCLUSION

The results of this clinical study conducted by ENT specialists among 123 patients suffering from vertigo and requiring the institution of medical treatment and/or physiotherapy demonstrate the reliability and responsiveness of the EEV scale.

The EEV scale is a physician-administered questionnaire which exclusively assesses the vestibular syndrome (vertigo and accompanying vestibular symptoms) by a physician-led interview.

Construct, convergent and discriminant validity was assessed by comparing the EEV scale with two vertigo-symptom scales (patient diary, conventional DPHM scale), one functional evaluation scale (AAO scale) and one generic quality-of-life scale (SF-36). At day 30, both the EEV subscores and the EEV global score showed a strong correlation with the scores on the other scales (conventional DPHM scale, AAO scale, SF-36); all the scores improved between day 0 and day 30. In contrast, at day 0, correlations between item subscores on the EEV scale and those on the other scales varied widely, with the exception of "intensity and number of attacks" on the conventional DPHM scale and physical dimension of the SF-36. This confirmed that the EEV scale rates symptoms and can thus be of value for assessing symptomatic treatment specifically aimed at the vestibular apparatus.

Lastly, the large number of specialists that were involved in developing the EEV scale guarantees its content validity.

The EEV scale is thus an original measuring tool, the first physician-administered questionnaire to evaluate only the clinical symptoms of the vestibular syndrome and to monitor its course, without taking account of the patient's emotional status or subjective handicap.

The excellent reliability and responsiveness of the EEV scale should allow physicians to calculate each item subscore as well as the global vertigo score and to monitor changes in score over time. This would be especially valuable when rapid clinical changes need to be assessed either because of central vestibular compensation or following anti-vertigo treatment, be it medication, physiotherapy or surgery.

Further studies on vertigo using the EEV scale should be conducted, both in France and in many other countries, to better determine the applicability of the scale, in particular according to the type of vertigo.

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REFERENCES

1 – Yardley L., Verschuur C., Masson E., Luxon L. and Haacke N. Somatic and psychological factors contributing to handicap in people with vertigo. Br J Audiol 1992 ; 26 : 283 – 290.

2 - Yardley L., Masson E., Verschuur C., Haacke N. and Luxon L. Symptoms, anxiety and handicap in dizzy patients : development of the vertigo symptom scale. J Psychosom Res 1992 ; 36 : 731 – 741.

3 – Yardley L. and Putman J. Quantitative analysis contributing to handicap and distress in vertiginous patients : a questionnaire study. Clin Otolaryngol 1992 ; 17 : 231 – 6.

4 – Kaufman Arenberg I., Jan Stable and George Goldman. Staging vertigo and the vertigogram. Curr Med Res Opin 1980 ; - (suppl. 10) : 7 – 18.

5 – Honrubia V., Bell T.S., Harris M.R., Baloh R.W. and Fisher L.M. Quantitative evaluation of dizziness characteristics and impact on quality of life. Am J Otol 1996 ; 17 : 595 - 602

6- Gates George A. Clinimetrics of Meniere's Disease. Laryngoscope 2000 ; 110 (suppl March) : 8-11.

7 – Jacobson G.P., Newman C.W. The development of the Dizziness Handicap Inventory. Arch Otolaryngol Head Neck Surg 1990 ; 116 : 424 –7.

8 Direction de la Pharmacie et du Médicament. Médicaments antivertigineux, circulaire du 6 juillet 1984. Ministère des Affaires Sociales et de la Solidarité Nationale, Paris - France

9- Alford B.R. Committee on Hearing and Equilibrium : report of subcommittee on equilibrium and its measurment : Ménière's disease criteria for diagnosis and evaluation of therapy for reporting. Trans Am Acad Ophtalmol Otolaryngol 1972 ; 76 : 1462 – 4.

10 – Monsell E.M. New and revised reporting guidlines from the Committee on Hearing and Equilibrium. Otolaryngol Head Neck Surg 1995 ; 113 : 176 – 8.

11– John E. Ware, Jr. The SF-36 Health Survey. In: Spilker B Eds. Quality of life and pharmacoeconomics in clinical trials. Second edition. Philadelphia : Lippincott-Raven publishers; 1996 : 337 – 345.

12 – Launois R. La qualité de vie : Panorama et mise en perspective. In Launois R and Régnier F., Eds. Décision thérapeutique et qualité de vie. Paris : John Libbey Eurotext; 1992 : 3 – 24.

13 – Moret L., Chwallow .J, Baudoin-Balleur C. : Evaluer la qualité de vie : construction d'une échelle. Rev Epidém Et Santé Publ 1993 ; 41 : 65 – 71.

14 – Nunnaly J.C. Psychometric theory. 2nd edition. New-York : McGraw Hill Book Company; 1978.

15 – Fleiss J.L. Design and analysis of clinical experiments. New-York : Ed. Wiley; 1986.

16 – Fermanian J. Problèmes méthodologiques et statistiques posés par l'utilisation d'échelles dans l'évaluation des troubles de la mémoire. Mémoire et vieillissement : approche méthodologique. Paris : Doin, Paris; 1989 : 281 – 291.

17– Guyatt G., Walter S., Norman G. Measuring change over time : assessing the usefulness of evaluative instruments. J Chron Dis 1987 ; 40 : 171- 178.

18 – Launois R., Reboul-Marty J., Henry B. Construction and validation of quality of life questionnaire in chronic lower limb venous insufficiency (CIVIQ). Quality of Life Research 1996 ; 5 : 539-554.

19– Kinney S.E., Sandridge S.A. and Newman. C.W. Long-term effects of Meniere's Disease on hearing and quality of life. Am J Otol 1997 ; 18 : 67 – 73.

Fig. 1 : EEV scale items. The physician-led interview covers the day of the visit and the previous seven days.

IllMOV	ILLUSION OF MOVEMENT
0	No illusion
1	.....
2	Feeling of swaying to the right or left, ascending or descending movements, light-headedness, listing, rolling.
3	.....
4	Impression of spinning (either of self or of the environment)

DurILL	DURATION OF THE ILLUSION
0	None
1	Less than 1 minute
2	1 minute to 1 hour.
3	1 hour to 3 hours
4	3 hours to 24 hours

MotINT	MOTION INTOLERANCE
0	No motion intolerance
1	Rarely or few
2	Sometimes or moderate
3	Often or marked
4	Always or intense.

NeuVEG	NEUROVEGETATIVE SIGNS
0	No neurovegetative signs
1	Nausea uncorrelated with attacks of vertigo
2	Nausea correlated with attacks of vertigo
3	Nausea associated with one or two episodes of vomiting
4	Intractable vomiting

InsTAB	INSTABILITY (including when under illusion)
0	No instability
1	Instability but no falls and no interference with daily life activity
2	Instability, without falls, but interferes with daily life activity
3	Instability with occasional falls, either when standing or when walking
4	Instability with falls as soon as the patient stands up

Table I : Change in EEV scores from day 0 to day 30

EEV Scale	day 0		day 7		day 30	
	m ± S.D.*	**med****	**m ± S.D.***	**med****	**m ± S.D.***	**med****
Illusion of Movement	1.99 ± 0.19	1.25	1.57 ± 0.09	1.38	0.55 ± 0.08	0.01
Duration of the Illusion	1.32 ± 0.06	1.00	1.14 ± 0.07	1.00	0.44 ± 0.07	0.01
Motion Intolerance	1.77± 0.10	1.63	1.29 ± 0.09	1.25	0.50 ± 0.08	0.01
Neurovegetative Signs	0.82 ± 0.07	0.50	1.47 ± 0.05	0.25	0.14 ± 0.04	0.01
Instability	1.33 ± 0.07	1.25	0.99 ± 0.06	0.94	0.46 ± 0.07	0.01
Global score	7.224 ± 0.291	7.125	5.470± 0.281	5.071	2.084 ± 0.285	0.438

* Mean ± Standard Deviation
** Median

Fig.1 : Evolution of EEV scores from day 0 to day 30.

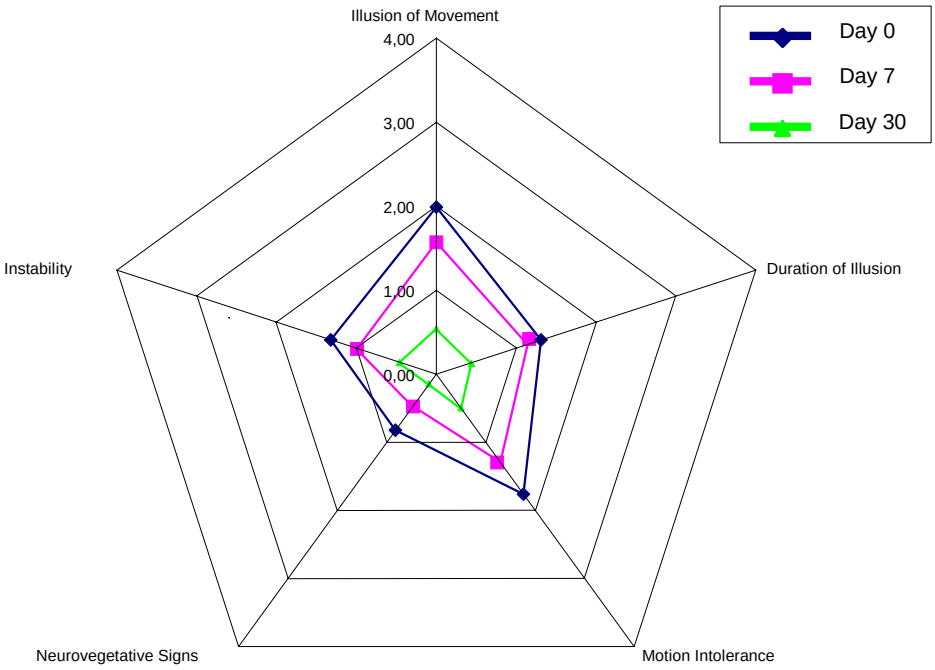

Table II : Change in number of attacks, based on patient diary, from day 0 to day 30

Number of attacks	Mean ± S.D.	Median
From day 0 to day 8	8.42 ± 1.12	3.00
From day 23 to day 30	2.56 ± 0.68	<0.01

Table III : Change in DPHM scores from day 0 to day 30

DPHM scale	m ± S.D.* day 0	med **day 0	m ± S.D.* day 7	med **day 7	m ± S.D.* day 30	med** day 30
Mean intensity of attacks	2.57 ± 0.08	3.00	1.79 ± 0.07	2.00	1.28 ± 0.06	1.00
Mean duration of attacks	2.11 ± 0.08	2.00	1.85 ± 0.08	2.00	1.82 ± 0.12	2.00
Mean number of attacks	9.82 ± 1.37	5.00	15.02 ± 2.37	6.00	13.10 ± 2.72	1.00

* Mean ± Standard Deviation
** Median

Table IV : Change in AAO scores from day 0 to day 30

AAO scale	mean ± S.D.	median
day 0	3.51 ± 0.11	3.00
day 7	2.58 ± 0.12	2.00
day 30	1.74 ± 0.11	1.00

Table V : Change in SF-36 dimension subscores and global score between day 0 and day 30

SF-36 scale	m ± S.D.* day 0	Median** day 0	m ± S.D.* day 30	Median** day 30
Physical Functioning	71.45 ± 2.48	75.00	81.44 ± 2.01	90.00
Physical Role	44.03 ± 6.37	25.00	57.86 ± 7.25	50.00
Bodily Pain	57.50 ± 2.66	52.00	68.43 ± 2.50	74.00
General Health	52.20 ± 0.93	52.00	52.52 ± 0.91	52.00
Vitality	40.76 ± 1.99	40.00	48.75 ± 1.77	50.00
Social Functioning	54.76 ± 2.71	50.00	67.50 ± 2.53	62.50
Emotional Role	45.03 ± 4.13	33.00	50.96 ± 4.60	50.00
Mental Health	52.40 ± 1.93	52.00	58.49 ± 1.83	60.00
Global score	418 ± 0.9		485 ± 95	

* Mean ± Standard Deviation
** Median

Fig 3 : SF-36 scale profile for patients with vertigo

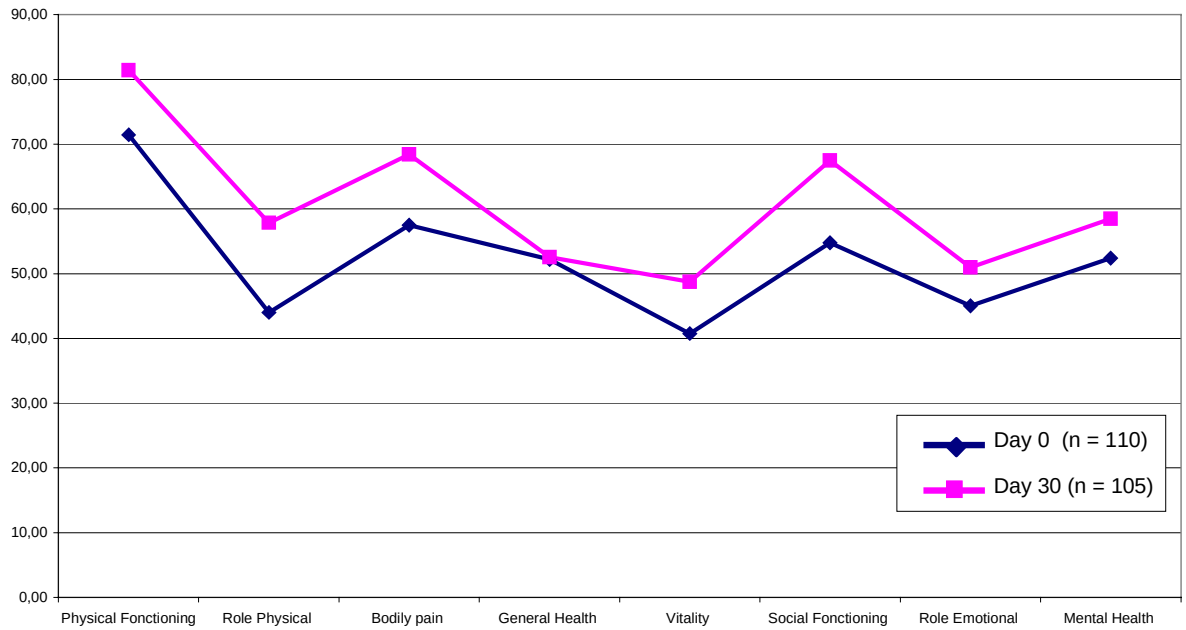

Table VI : EEV scale, validation of reli ability (Wilcoxon Signed Rank Test)

	Illusion of Movement	Duration of Illusion	Motion Intolerance	Neurovegetative Signs	Instability	Global score

Z (Wilcoxon)	- 0.141[a]	- 0.376[a]	-1.274[b]	- 2.214[b]	- 0.516[b]	- 0.930[b]
" p " (Wilcoxon test)	0.888	0.707	0.203	0.027	0.606	0.352

a = Based on negative ranks
b = Based on positive ranks

Table VII : EEV scale, validation of responsiveness (Wilcoxon Signed Rank Test)

	Illusion of Movement	**Duration of Illusion**	**Motion Intolerance**	**Neurovegetative Signs**	**Instability**	**Global score**
Z (Wilcoxon)	- 8.170[a]	- 7.685[a]	- 7.505[a]	- 7.176[a]	- 7.255[a]	- 8.163[a]
" p " (Wilcoxon test)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

a = Based on negative ranks

Table VIII : Verification of responsiveness - calculation of the size effect and the Guyatt statistic.

	EFFECT SIZE	**GUYATT statistic**
EEV scale		
Illusion of Movement	1.50	1.52
Duration of Illusion	1.43	1.33
Motion Intolerance	1.28	1.14
Neurovegetative Signs	0.99	0.97
Instability	1.26	1.19
Global score	1.75	1.67
SF-36 scale		
Physical Functioning	0.47	0.57
Physical Role	0.25	0.21
Bodily Pain	0.44	0.43
General Health	0.15	0.15
Vitality	0.41	0.48
Social Functioning	0.60	0.62
Emotional Role	0.27	0.24
Mental Health	0.36	0.37

Table IX : Convergent and discriminant validity with respect to the DPHM scale

EEV scale		**Mean intensity of vertigo**			**Mean number of attacks**			**Mean duration of attacks**		
		day 0	day 7	day 30	day 0	day 7	day 30	day 0	day 7	day 30
Illusion of Movement	Corr.	0.087	0.335	0.663	0.612	0.569	0.917	-0.288	0.029	-0.050
	p	0.338	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.761	0.714
	N	*123*	*118*	*114*	*123*	*114*	*114*	*123*	*110*	*56*
Duration of Illusion	Corr.	0.014	0.364	0.680	0.300	0.405	0.903	0.374	0.502	0.246
	p	0.876	<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001	0.068
	N	123	118	114	123	114	114	123	110	56
Motion Intolerance	Corr.	0.096	0.370	0.601	0.472	0.452	0.753	-0.225	-0.017	0.050
	p	0.289	<0.001	<0.001	<0.001	<0.001	<0.001	0.012	0.859	0.713
	N	*123*	*118*	*114*	*123*	*114*	*114*	*123*	*110*	*56*
Neurovegetative Signs	Corr.	0.284	0.296	0.625	0.122	0.175	0.443	0.133	0.202	0.272
	p	0.001	0.001	<0.001	0.178	0.058	<0.001	0.141	0.034	0.043
	N	*123*	*118*	*114*	*123*	*114*	*114*	*123*	*110*	*56*
Instability	Corr.	0.208	0.373	0.621	0.416	0.274	0.738	- 0.015	0.181	0.090
	p	0.021	<0.001	<0.001	<0.001	0.003	<0.001	0.865	0.058	0.509
	N	*123*	*118*	*114*	*123*	*114*	*114*	*123*	*110*	*56*
Global score	Corr.	0.16	0.44	0.65	0.55	0.52	0.87	-0.10	0.17	0.09
	p	0.008	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.51
	N	*123*	*118*	*114*	*123*	*118*	*114*	*123*	*110*	*56*

Table X : Convergent and discriminant validity with respect to the AAO scale

EEV scale		**AAO scale**		
		day 0	day 7	day 30
Illusion of Movement	Corr.	-0.013	0.410	0.794
	p	0.883	<0.001	<0.001
	N	*123*	*118*	*111*
Duration of Illusion	Corr.	0.208	0.522	0.797
	p	0.021	<0.001	<0.001
	N	*123*	*118*	*111*
Motion Intolerance	Corr.	0.042	0.453	0.754
	p	0.645	<0.001	<0.001
	N	123	118	111
Neurovegetative Signs	Corr.	0.348	0.375	0.615
	p	<0.001	<0.001	<0.001
	N	*123*	*118*	*111*
Instability	Corr.	0.225	0.550	0.719
	p	0.012	<0.001	<0.001
	N	*123*	*118*	*111*
Global score	Corr.	0.140	0.560	0.810
	p	0.11	0.001	0.001
	N	*123*	*118*	*111*

Table XI : Convergent and discriminant validity with respect to the SF-36 scale.

		Physical Functioning		**Physical Role**		**Bodily Pain**		**General Health**		**Vitality**		**Social Functioning**		**Emotional Role**		**Mental Health**	
		day 0 n=107	30 n=104	day 0 n=113	30 n=105	day 0 n=115	30 n=107	day 0 n=100	30 n=96	day 0 n=112	30 n=104	day 0 n=105	30 n=100	day 0 n=114	30 n=104	day 0 n=110	30 n=106
Illusion of movement	Corr. p	-0.207 0.033	0.399 <0.001	-0.027 0.780	-0.397 <0.001	-0.218 0.019	-0.274 0.004	-0.012 0.906	0.118 0.252	-0.227 0.016	-0.446 <0.001	-0.115 0.242	-0.353 <0.001	-0.038 0.688	-0.423 <0.001	-0.154 0.109	-0.433 <0.001
Duration of illusion	Corr. p	-0.242 0.012	0.381 <0.001	-0.216 0.022	-0.401 <0.001	-0.245 0.008	-0.268 0.005	-0.087 0.392	0.153 0.136	-0.304 0.001	-0.436 <0.001	-0.250 0.010	-0.351 <0.001	-0.170 0.071	-0.420 <0.001	-0.173 0.071	-0.428 <0.001
Motion intolerance	Corr. p	-0.303 0.002	0.389 <0.001	-0.033 0.731	-0.449 <0.001	-0.226 0.015	-0.259 0.007	-0.085 0.400	0.181 0.077	-0.167 0.079	-0.474 <0.001	-0.029 0.768	-0.420 <0.001	-0.004 0.970	-0.470 <0.001	-0.162 0.092	-0.449 <0.001
Neurovegetative signs	Corr. p	0.169 0.081	0.257 0.008	-0.292 0.002	-0.268 0.006	-0.114 0.225	-0.199 0.040	-0.090 0.375	0.196 0.055	-0.197 0.038	-0.315 0.001	-0.219 0.025	-0.371 <0.001	-0.166 0.077	-0.376 <0.001	-0.182 0.057	-0.362 <0.001
Instability	Corr. p	-0.393 <0.001	0.400 <0.001	-0.253 0.007	-0.441 <0.001	-0.343 <0.001	-0.346 <0.001	-0.050 0.620	0.245 0.016	-0.287 0.002	-0.506 <0.001	-0.255 0.009	-0.364 <0.001	-0.272 0.003	-0.459 <0.001	-0.237 0.013	-0.420 <0.001
Global score	Corr. p	-0.339 <0.001	0.428 <0.001	-0.150 0.112	-0.456 <0.001	-0.288 0.002	-0.301 0.002	-0.063 0.533	0.227 0.026	-0.270 0.004	-0.493 <0.001	-0.159 0.106	-0.393 <0.001	-0.102 0.279	-0.483 <0.001	-0.196 0.040	-0.445 <0.001