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ORIGINAL REPORT

IDENTIFYING PATTERNS OF PSYCHOGENIC GAIT BY VIDEO-RECORDING

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Objectives: **Psychogenic gait is common in patients with medically unexplained neurological symptoms and provides significant challenges to healthcare providers. Clinicians may arrive at a correct diagnosis earlier if distinctive positive signs are identified and acknowledged. This study aims to offer a tool for identifying patterns of psychogenic gait based on positive signs in clinical settings.**
Design: **A video study with assessment of inter-rater reliability.**
Patients: **Thirty consecutive patients diagnosed with psychogenic gait disturbance by neurologist before inclusion.**
Methods: **In a gait laboratory patients were first categorized into 3 categories by 2 of the authors. Another rater was given both oral and written guidance and the next 3 raters only written information. Inter-rater reliability was estimated between the first and the 4 other ratings.**
Results: **The main finding was that psychogenic gait could be categorized into 3 categories. These were: limping of 1 leg, limping of 2 legs; and truncal imbalance. Inter-rater reliability of the classification in the various categories was high.**
Conclusion: **The present study provides the clinician with 3 well-described patterns to examine for if a psychogenic gait disorder is suspected, thereby simplifying detection.**

Key words: psychogenic aspects; conversion disorder; gait.

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INTRODUCTION

Psychogenic gait is common in patients with medically unexplained neurological symptoms. In neurological outpatient clinics as much as 30–60% of the patients have no detectable organic disorder that can explain their walking disturbance (1–4). Various terms have been used to describe this situation, such as conversion disorder or functional symptoms. In this study we use the term psychogenic gait, which is most commonly used in the literature (5–8).

Traditionally, much effort has been made to rule out organic disease in these patients. Although this still has to be done, clinicians may arrive at a correct diagnosis earlier on if distinctive positive signs are identified and acknowledged. Doctors' fear of overlooking organic illness may lead to potentially harmful, unnecessary examinations (9), even though studies state that somatic illness is less overlooked in somatization patients than in somatic patients (2, 10, 11). Given this frequency of psychogenic gait disturbances, it is important for clinicians to have access to optimal diagnostic tools to identify these patterns of gait. This will facilitate the diagnostic process and reduce the delay in reaching a correct diagnosis, which is common among these patients. As soon as a diagnosis of psychogenic gait disturbance is suspected, the patient may avoid further waste of time and receive optimal treatment. At the group level, the number of examinations could be minimized if diagnostic tools were available.

Diagnostic criteria for psychogenic gait based on analysing video-recordings of cases have been proposed previously by Lempert et al. (7). They evaluated 37 neurological inpatients with disturbed gait, in whom no organic aetiology was detected, and described 6 categories and 6 suggestive features for psychogenic gait patterns (Table I).

Later studies addressing the same issue have arrived at similar conclusions (12–14). However, the descriptions of gaits in these studies are rather general and the details given are few. Thus, their findings are difficult to replicate. Furthermore, their value as a clinical tool is limited, as the number of 6 categories and 6 suggestive features is difficult to handle in busy clinical settings. An important question is whether this number might be reduced, by clustering related patterns of gait into broader, yet well-described categories. By doing so, clinicians might be supplied with a limited number of features to examine for whenever a non-organic disturbance of walking is suspected. Such a tool would facilitate the diagnostic process and be more convenient to use.

The purpose of this investigation was to propose a simplified diagnostic tool for identifying psychogenic gait patterns, based on Lempert's previous categories.

METHODS

Patients

The study was conducted at the Clinic of Physical Medicine and Rehabilitation Vestfold Hospital Trust, which has a catchment population of approximately 400,000 from the South-Eastern region of Norway. The clinic has, for a long time, had specialized competence in the rehabilitation of these patients. This is well known among neurologists

Table I. *Six categories and 6 suggestive features of gait (7)*

1. Abstract: "Momentary fluctuations of stance and gait, often in response to suggestion"
   Table: "Fluctuation of impairment"
2. Abstract: "Excessive slowness or hesitation of locomotion incompatible with neurological disease"
   Table: "Excessive slowness of movements"
3. Abstract: "Psychogenic Romberg test with a build-up sway amplitudes after a silent latency or with improvement by distraction"
   Table: "Psychogenic Romberg test"
   Carried out in 25 out of 37 patients
4. Abstract: "Uneconomic postures with wastage of muscular energy"
   Table: Identical text
5. Abstract: "The walking on ice gait pattern, which is characterized by small cautious steps with fixed ankle joints"
   Table: "Walking on ice" gait pattern
6. Abstract: "Sudden buckling of the knees, usually without falls"
   Table: "Sudden buckling with/without falls"
   Six suggestive features:
   - Pseudoataxia: Instability of posture and gait
   - Sudden sidesteps
   - Flailing of the arms
   - Dragging of the leg
   - Continuous flexion/extension of the toes
   - Bizarre tremors of hands/legs/trunk/head

in the area, who refer these patients for rehabilitation. Between March 2007 and May 2010 we studied 30 consecutive patients, who had been diagnosed with a non-organic gait disturbance at neurological clinics in the catchment area and were referred for rehabilitation.

Patients were admitted as inpatients for a pre-planned 3-week period, and were included in the study after informed consent had been obtained. Inclusion criteria were: a present severe walking disability not otherwise explained, age 18–80 years, duration of walking disturbance < 5 years, and willingness to participate in the study.

The patients were all ethnic Norwegians and 77% were females. Mean age was 38.4 years (SD 10.1; range 18–58). Duration of symptoms varied from 1 to 48 months, mean 10.2 months (SD 11.5) , and mean duration of education after public school was 2.2 years (SD 2.1).

Procedure

Each patient was video-taped once in a gait laboratory while walking a distance of 8 m. The video-taping was performed during the second to the fourth day of their stay. Whenever a patient was using a wheelchair and was unable to walk, as was the case for 3 of our patients, taping was postponed until he or she was able to walk. We elaborated a standard procedure that included standing, walking with open eyes, walking fast and slowly, and a full knee bend. Video-recording was performed from the back and from the side by using two video-cameras. The sequences of videotapes varied from 4 to 8 min, depending on the patient's speed of motion.

The videotapes were evaluated by 6 raters. These included: the first author (AAJ), a specialist in adapted physical activity (APA), the second author (LMS), a MD with specialty in rheumatology, the third and fourth raters where specialists in physiotherapy with master in movement sciences, rater number 5 was an APA specialist and rater number 6 was a physician. The tapes were initially examined and reviewed carefully by 2 of the authors (AAJ and LMS). The gait observed in each patient was openly discussed and reviewed several times. The pattern of the individual patient's gait was then compared with the categories of Lempert et al. (7), and it was attempted to fit it into one or more categories. As Lempert et al.'s descriptions provide a limited number of details, the fit was far less than perfect. We rewrote the categories most often observed, aiming at describing them more precisely and in greater detail. Whenever two phenomena of gait appeared closely related in the individual patient, we extended the original category to comprise both, thus clustering related characteristic traits of gait. The video-tapes were then reviewed in light of the revised set of categories, and minor adjustments of the descriptions were made. The video of each patient was then openly discussed by both authors together, according to this revised set of categories, until agreement was reached. Thus we ended up with 3 categories (Table II).

To test the reliability of this revised set of characteristic features, the videos were rated by the third author (VPM), who was blind to the original ratings. This rater was given a verbal explanation and a physical demonstration, along with the written description of the patterns of gait. Finally, 3 additional raters, blinded to the previous scorings conducted the fourth, fifth and sixth rating. These 3 raters were provided only with the written descriptions of the categories, and no additional verbal explanations or demonstrations. By doing so, we intended to examine the reliability of the written descriptions in their own right, thus testing their performance as a tool to any reader.

By comparing these ratings with the consensus scores of the two first authors we were able to estimate inter-rater reliability of the classification into the various categories. Kappa was developed for use with ordinal data and reflects degree of agreement by attaching greater emphasis to large differences between ratings compared with small differences (15). The percentages of exact agreement were used to analyse the agreement between the consensus scores and each of the other raters. Kappa values were computed for each category between the consensus scores and the other ratings. A p-value < 0.05 was considered significant. The strength of agreement was established using the kappa values previously reported by Landis & Koch (16) as: poor < 0.00, slight 0.00–0.20, fair 0.21–0.40, moderate 0.41–0.60, substantial 0.61–0.80, and almost perfect 0.81–1.00.

Table II. *The 3 characteristic gaits of our study*

1: Severe limping on 1 leg, often with dragging of the foot
This pattern characteristically affects 1 leg, whereas the other is moved as normal or close to normal. The preferred pattern of limping is that of dragging the foot. During dragging, the foot, and especially the forefoot, is kept in contact with the floor in all of the phases of gait. The leg and/or the foot is often rotated laterally or medially. The gait resembles that of hemiparetic patients, and the limping is severe. The hip and knee may be fixed in an extended position as if walking with a wooden stock for a leg. The pattern is observed consistently during all of the walking sequences and is easily identified. The limping engages the same leg and has the same pattern in the individual patient, but may vary between patients. A sudden buckling of the hip and knee may appear, normally without falling. The gait is often surprisingly quick in spite of the severe limping observed.

2: Walking with small, slow steps with both legs as if walking on ice
This pattern is characterized by abnormal motion of both legs. The gait resembles walking on ice. Walking is slow due to the short steps taken as well as a slow motion itself. The hips and knees are often, but not always, kept in a slight flexion position with no full extention in any phase of stance or gait. This gives the walking a rigid, Parkinsonistic character. The patients seem to coactivate their leg muscles in general, rendering the gait stiff and cautious.
There is hesitation in the transition from stance to walking, and when walking eventually is initiated, the steps are slow and short.

3: Truncal ataxia/imbalance
There is instability of the truncal position upon walking with the body axis swaying vertically from 1 side to the other. Often, small side steps are made to restore the truncal balance in order not to fall. A flailing of the arms often occurs. The swaying is observed in the upper half of the body, whereas the legs are moved to correct the imbalance resulting when the body vector is moved away from the weight line of the body. The person seems to be moving the legs to avoid falling and restore the truncal balance.

RESULTS

When the first and second author reviewed the videos together, we found that, among the 30 patients, 23 had one characteristic feature, while 3 had no characteristic gait disturbance captured on the video. In the remaining 4 cases, truncal imbalance (category 3) and severe limping on one leg (category 1) were present at the same time, while truncal imbalance and walking with slow steps with both legs (category 2) occurred together in 1 patient.

Levels of agreement between the consensus scores and the third rater, who was given both written description and oral instructions, was almost perfect for category 1 and 3, and substantial for category 2.

Levels of agreement between the consensus scores and the fourth rater, who was only given the written instructions, were substantial for category 1, and almost perfect for category 3. The exception was category 2, where the agreement was fair.

The Kappa values are shown in Table III.

The ratings and feedback from the fourth rater, who only received the written instructions, indicated that category 2 was not adequately described. As a consequence we made minor adjustments of the wording, aiming to make it more informative to the reader, by emphasizing that the gait disturbance concerns slow gait in *both* legs and that parkinsonistic features only is a suggestion and not required.

This revised version was given to the last two raters and is shown in Table II.

Levels of agreement between the consensus scores and the fifth rater were now substantial for all categories. Levels of agreement between the consensus scores and the sixth rater were almost perfect agreement for category 1 and substantial for categories 2 and 3.

The ratings performed by all raters are presented in Table IV.

DISCUSSION

Three characteristic patterns of psychogenic gait were identified by studying video-recordings of 30 patients referred to rehabilitation. This is a simplification of the 6 criteria described by Lempert et al. (7). Independent raters achieved strong levels of agreement when classifying patients according to these new categories.

Table III. *Kappa values of inter-rater reliability between consensus scores and 4 other raters*

Kappa values	3rd rater	4th rater	5th rater	6th rater
Category 1	0.87[a]	0.67[b]	0.73[b]	0.93[a]
(95% CI)	(0.69–1.00)	(0.42–0.92)	(0.49–0.97)	(0.80–1.00)
Category 2	0.75[b]	0.39[c]	0.75[b]	0.68[b]
(95% CI)	(0.49–1.00)	(0.02–0.77)	(0.49–1.00)	(0.40–0.97)
Category 3	0.92[a]	0.85[a]	0.68[b]	0.62[b]
(95% CI)	(0.76–1.00)	(0.65–1.00)	(0.40–0.97)	(0.31–0.92)

[a]Almost perfect agreement; [b]substantial agreement; [c]fair agreement.
95% CI: 95% confidence interval.

Three patients had no severe walking disturbance during the time of videotaping, even though they had been severely disabled at admission a few days earlier. This apparent variability in gait over a short time span fits well with Lempert et al's. (7) first criterion, i.e. fluctuations of impairment. Such fluctuations are difficult to capture during the short time of video-filming, and would also be difficult to capture during an outpatient consultation, and this feature is therefore not included as a category in our study.

We found that Lempert et al's. (7) category 2; excessive slowness and category 5; walking on ice, to be related patterns, and clustered both features in our category 2. Furthermore, we observed truncal imbalance in 9 patients. This phenomenon fits with the psychogenic Romberg test in Lempert's category 3 as well as the pseudo-ataxia in 1 of the 6 suggestive features. In

Table IV. *Classification of 30 patients, comparing 4 raters with consensus made by the two first raters*

Patient number	Sex	Age, years	1st and 2nd rater in common	3rd rater	4th rater	5th rater	6th rater
1	Male	21	3	3	3	3	3
2	Female	27	1	1	1	1	1
			3	3	3	3	
3	Female	49	1	1	1	1	1
4	Male	45	3	3	3	3	3
5	Female	41	3	3	3	2	2
			2	1	1	3	3
6	Female	43	1	1	1	1	1
7	Female	43	1	1	1	1	1
8	Female	43	3	3	3	2	3
				2			
9	Female	44	2	2		2	2
				1	1	1	
10	Female	18	1	1	1	1	1
			3	3	3	3	3
11	Female	30	1	1	1	1	1
			3	3	3		
12	Male	24	2	2	1	2	2
13	Female	44	–	–	–	–	–
14	Female	35	1	1	1	1	1
15	Female	55	1	1	1	1	1
16	Male	47	2	2	1	1	2
17	Male	31	–	–	–	–	2
18	Female	38	2	2	2	2	2
19	Female	23	3	3	3	3	3
20	Female	33	–	–	–	–	2
							3
21	Female	46	1	1	1	1	1
22	Female	39	1	1	1	1	1
23	Female	58	2	2	2	2	2
					3		3
24	Male	38	1	1	1	1	2
					2	3	
25	Female	38	1	1	1	1	1
26	Female	38	2	2	1	1	3
						2	
27	Female	33	1	1	1	1	1
28	Female	48	2	2	2	2	2
29	Female	33	1	1	1	3	1
30	Male	52	3	2	3	2	3
						3	

our study, however, no formal Romberg test was carried out. However, truncal imbalance was one of the most characteristic patterns in our videos. Excessive wastage of muscular energy during walking is labelled as an individual, specific feature in the studies of Lempert et al. (7) and Baik & Lang (12). In our study, excessive use of muscular energy was characteristic for all the patterns of gait. In our view, severe limping, truncal imbalance with bodily sways and walking with small, short steps all represent uneconomic patterns of gait, which demand an excessive use of muscular energy. Given the low specificity of these phenomena, we did not include them as a specific category. The two remaining suggestive features referred by Lempert et al (7); continuous flexion/extension of the toes and bizarre tremors of hands/legs/trunk/head, do not necessarily lead to severe gait disturbance, as was our inclusion criterion. Thus we did not find these in our material, and the features are therefore not included in our categories.

We found that it is possible to reliably identify 3 categories of gait. The reliability between independent raters was high. The third rater, with only written instruction, experienced that the wordings in categories 1 and 2 made distinction between them difficult, thus resulting in an over-presentation of patients in category 1. However, after a minor adjustment of the written instructions of category 2, we believe the differences between categories 1 and 2 will be more easily captured. The result, with almost perfect and substantial agreement from the two last raters using these revised descriptions, confirmed this. Our results correspond well with previous studies defining diagnostic features (7, 8, 17). Fhan & Williams (8) outlined, also with some use of video, a classifications system of diagnostic certainty not based on exclusion but defining psychogenic gait by positive indicators. In a retrospective survey of 60 cases, 32 of which were documented on video, the description of the clinical phenomena was similar to our findings in our material (10).

This study is limited by the small sample size. Our sample is selected, and the types and distribution of gait disturbances are not necessarily representative of psychogenic gait disturbances in general (5). There could, of course, be gait patterns of non-organic nature that are not described in these 3 categories, but this was not the case in sample.

There are few men in the material (8/22), but the overrepresentation of females fits well with other samples and it is therefore reason to believe this is representative (5, 11, 18–20). Compared with other studies, the mean symptom duration of 10 months indicates a much shorter diagnostic process than usual. There is reason to believe that this is due to the close collaboration with the neurological clinics in dealing with this group of patients in our region.

Another question is to what degree walking in a gait laboratory is representative of the clinical setting. In both settings the individual is asked to walk on the floor. On a video-clip it is possible to view the gait several times, but this is not so easy in the clinical setting. We do not know if or how video-taping in a laboratory affects the patient's gait performance. Clinicians gain an overall impression of the patient, which is a made up from a synthesis of history-taking, the general behaviour of the patient, observation of spontaneous motor function during the consultation, and the clinical examination itself (21). Suspicion of a non-organic condition may arise from any of these elements. During the examination of mobility in patients with psychogenic gait disturbance, perhaps the most striking phenomenon is that the walking itself appears bizarre. The rhythm of the gait seems oddly disturbed and "the melody of walking" differs from normal gait in strange ways. An experienced clinician will note this. However, as the finding is subtle and difficult to define, this important clinical cue may be missed due to lack of a tool for describing it, thereby delaying the correct diagnosis. This reflection is shared by other authors, including Lempert et al. (7). The present study is also in keeping with the views ofthese authors, as we were not able to define an exact impression of the patients' unusual basic movement. In this study we describe 3 patterns of psychogenic gait disturbance. The patterns comprise abnormal moving of either one or both legs and truncal imbalance. One may argue that these phenomena are so common in any neurological or orthopaedic clinic that the finding is of no value. In other words, the 3 patterns are by no means specific to psychogenic disorders and are of little help when examining patients limping or swaying. This argument stands to reason. Thus, we do not advocate the 3 categories applied as the only tool in case detection. However, our findings may be applied in a different setting: Whenever the suspicion of a non-organic walking disturbance is evoked in the mind of the clinician, there are 3 common patterns to examine for. Such a suspicion may occur by the first minute of talking to the patient (2). Thus, the alertness of these 3 traits may be helpful when expressing a vague experience of "something wrong" as an explicit argument for a functional gait disturbance. In that case, the clinical impression of a bizarre gait will not be dismissed so easily, and the patient will receive a correct diagnosis and proper treatment earlier. As the present study results in only 3 distinct characteristics to examine for, their detection is simplified, and as this study shows, the classification is reliable.

The level of agreement between independent raters using our criteria was high.

The 3 categories are not sufficiently specific to serve as case detectors for functional gait disturbances. However, for cases in which there is the suspicion of a functional gait disturbance, the present study provides the clinician with 3 well-described patterns to examine for, thereby simplifying detection. Further studies are needed to assess the validity and reliability of our findings in other samples.

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