© Med Sci Monit, 2008; 14(6): CR316-322
PMID: 18509275

WWW.MEDSCIMONIT.COM
Clinical Research

Received: 2007.07.26
Accepted: 2008.02.12
Published: 2008.06.01

Impact of clinical, psychological, and social factors on decreased Tinetti test score in community-living elderly subjects: A prospective study with two-year follow-up

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

Patrick Manckoundia[1,2,3 ABCD], Frédérique Thomas[4 ACFG], Séverine Buatois[5 CD], Louis Guize[4 CFE], Bertrand Jégo[4 CEF], Jean-Pierre Aquino[6 EF], Athanase Benetos[1,5 BCEF]

[1] Department of Geriatrics and Internal Medicine, Hospital of Brabois, University Hospital, Vandoeuvre-lès-Nancy, France
[2] Department of Geriatrics and Internal Medicine, Hospital of Champmaillot, University Hospital, Dijon, France
[3] INSERM/U887 Motricity-Plasticity. University of Burgundy, Dijon, France
[4] Center for Preventive and Clinical Investigations, Paris, France
[5] Center for Research and Education on Aging, University Hospital, Vandoeuvre-lès-Nancy, France
[6] „Porte Verte" Clinic, Versailles, France

Source of support: Departmental sources

Summary

Background: Balance and gait are essential to maintain physical autonomy, particularly in elderly people. Thus the detection of risk factors of balance and gait impairment appears necessary in order to prevent falls and dependency. The objective of this study was to analyze the impact of demographic, social, clinical, psychological, and biological parameters on the decline in balance and gait assessed by the Tinetti test (TT) after a two-year follow-up.

Material/Methods: This prospective study was conducted among community-living, young elderly volunteers in the centre "Investigations Préventives et Cliniques" and "Observatoire De l'Age" (Paris, France). Three hundred and forty-four participants aged 63.5 on average were enrolled and performed the TT twice, once at inclusion and again two years later. After the two-year follow-up, two groups were constituted according to whether or not there was a decrease in the TT score: the "TT no-deterioration" group comprised subjects with a decrease of less than two points and the "TT deterioration" group comprised those with a decrease of two points or more. Selected demographic, social, clinical, psychological, and biological parameters for the two groups were then compared.

Results: Statistical analysis showed that female sex, advanced age, high body mass index, osteoarticular pain, and a high level of anxiety all have a negative impact on TT score.

Conclusions: Knowledge of predictive factors of the onset or worsening of balance and gait disorders could allow clinicians to detect young elderly people who should benefit from a specific prevention program.

key words: balance • elderly • gait

Full-text PDF: http://www.medscimonit.com/fulltxt.php?ICID=859035

Word count: 3598
Tables: 2
Figures: –
References: 31
Author's address: Patrick Manckoundia, Service de Médecine Interne Gériatrie Hôpital de Champmaillot CHU, BP 87 909, 2, rue Jules Violle, F-21 079 Dijon Cedex, France, e-mail: patrick.manckoundia@chu-dijon.fr

PERSONAL USE ONLY
This copy is for personal use only - distribution prohibited.
Electronic PDF security powered by IndexCopernicus.com

BACKGROUND

Aging is associated with a decrease in the efficiency of several functions, among which are posture and gait [1–5], even in the absence of disease. Indeed, both posture and gait can be affected by normal or pathological aging. With advancing age, changes related to normal aging and those associated with diseases and their treatments can affect the systems that regulate balance and posture, i.e. the musculoskeletal, vestibular and central and peripheral nervous systems [6]. Falls are one of the most serious outcomes of poor balance and posture disturbances in the elderly. The prevalence of falls is evaluated at 33% after 65 years and reaches 50% after 80–85 years [7]. Ten percent of falls result in psychological consequences or serious injuries [8–10]. Because of these physical and psychological consequences, fallers are at a high risk of loss of autonomy, social isolation, and institutionalization. Therefore. falls associated with balance and gait disorders are a major public health problem.

The Tinetti test (TT) has been recommended and widely used in the elderly to assess mobility, balance, and gait [11]. This test assesses balance and gait with a number of items which vary according to the version used. The TT is easy to administer in a clinic, in an institution, or at home by health professionals. Though the TT appears to be an excellent tool to assess balance in some everyday situations and gait in elderly people, its validity in predicting the risk of falling has not been clearly established. However, some studies found that this test showed acceptable characteristics to recommend it as a screening test for falls [12].

Predicting balance and gait decline is essential in order to prevent dependency induced by falls in future elderly people. Some studies in the literature have assessed the role of sensorial, sensitive, and motor functions in TT score decreases [5]; however, to our knowledge no author has studied the clinical, psychological, and social parameters that have an impact on TT score decrease. We thus conducted a prospective study in community-living young elderly subjects in order to detect demographic, social, clinical, psychological, and biological factors predicting a decline in balance and gait as assessed by the TT [11]. This scale was chosen because, on the one hand, it is among the best tools used for the assessment of balance and gait in the elderly and, on the other hand, prediction of the risk of falling was not the main objective of this study.

MATERIAL AND METHODS

Participants

This study was conducted among 344 young elderly volunteers aged 63.5±4.0 on average (range: 55.5–84.7 years) recruited over a two-year period after giving their informed consent. All subjects were apparently healthy, i.e. without serious or unstable comorbidities, including those which contraindicate physical exercise, and were volunteers particularly interested in their health. They lived at home, had no signs of loss of autonomy, and regularly performed everyday life activities. Among the 344 subjects, 59 (17.2%) were being treated for hypertension and 24 (7%) for hypercholesterolemia. In accordance with the aim of the study, there were no exclusion criteria. This study, performed in the context of prevention and screening, was conducted at two centers: the "Investigations Préventives et Cliniques" (IPC), an organization concerned with clinical prevention, and the "Observatoire De l'Age" (ODA), specialized in the study of age-related problems. The approval of a local ethics committee was obtained and the regional ethics committee was informed.

Balance and gait assessment

Balance and gait were assessed using the TT [11]. The version of the TT used for this study included a 13-item balance and a 9-item gait assessment. For each item, the score was 1 point when the execution of the task was normal and 0 points when the subject could not accomplish the task. The maximum total was thus 22, i.e. the subject could perform all of the tasks. The higher the total score, the better the performance. All participants had to perform the TT twice, once at inclusion and again two years after the beginning of the study. We considered that the subject showed a deterioration in balance and gait when his/her TT score decreased by at least two points between the two assessments (at inclusion and two years later). Two groups were constituted according to the TT score decrease. The "TT deterioration" group comprised subjects presenting a decrease in the TT score of two points or more at the two-year follow-up and the "TT no-deterioration" group comprised those whose TT score fell by less than two points.

Social and medical questionnaire

Questioning concerned the lifestyle of the subjects (alone, with their spouse and/or other members of their family), the practice of a professional activity, the existence of financial problems, the usual practice of physical exercise, the consumption of tobacco and alcohol, the number of types of drugs consumed per day, and the use of antihypertensive or psychotropic drugs. Men were considered to be non-drinkers when they did not drink any alcoholic drinks, light drinkers in the case of consumption of 1 to 2 glasses (200 ml) of drink (wine or beer) per day, medium drinkers with 3 to 5 glasses per day, and heavy drinkers when the consumption was higher than 5 glasses per day. Women were considered to be non-drinkers when they did not drink any alcoholic drinks, light drinkers in the case of consumption of 1 glass of drink per day, medium drinkers with 2 to 3 glasses per day, and heavy drinkers when the consumption was higher than 3 glasses per day. Participants were also asked if they had osteoarticular pain and visual and hearing disorders.

The level of dependency of the participants was assessed by a questionnaire based on the following thirteen items: seeing even with glasses, hearing even with hearing aids, chewing, walking without assistance, walking at least 30 minutes daily, visiting friends at their homes, practice of physical activity at least one time per week, going up or down the stairs, execution of everyday activities, existence or not of an uncomfortable tremor, existence or not of occasional loss of consciousness, balance, and urinary continence status. Each item was scored 1 point in case of difficulty or abnormality and 0 points if not. Then a dependency score was established by adding the points obtained for all of the questions (maximum 13). The higher the score, the more dependent was the subject.

PERSONAL USE ONLY

This copy is for personal use only - distribution prohibited.

Electronic PDF security powered by IndexCopernicus.com

Their level of anxiety was assessed according to the following seven questions: "Do you lose sleep when you worry too much?", "Are you worried by obsessions?", "Do you worry about everything?", "Do you find it difficult to chase negative thoughts from your mind?", "Are you afraid that something bad will happen to you?", "Are you worried about your future?", and "Are you worried about your past?". The question was scored 1 point if the response was "yes" and 0 points if the response was "no". Then an anxiety score was established by adding the points obtained for all of the questions (maximum 7). The higher the score, the more anxious was the subject.

Finally, the Neugarten test was used to assess the life satisfaction index of the participants [13].

Clinical and biological assessment

For each subject, blood pressure, body weight, and height were measured and the body mass index (BMI) was calculated. Glycemia and total cholesterol were measured under fasting conditions.

Data and statistical analysis

The statistical analysis evaluated the influence of the demographic, clinical, psychological, biological, and social parameters on TT score decrease after a two-year follow-up. Chi-squared or Fisher's exact tests (qualitative parameters) and Student's *t*-test (quantitative parameters) were used to compare the "TT no-deterioration" and "TT deterioration" groups with regard to the following variables at inclusion: sex, age, lifestyle, practice of professional activity, existence of financial problems, practice of physical exercise, tobacco and alcohol status, BMI, existence of osteoarticular pain, existence of visual disorders, existence of hearing disorders, dependence score, anxiety score, Neugarten test score, number of types of drugs consumed per day, use of antihypertensive or psychotropic drugs, blood pressure, glycemia, and cholesterolemia. After identifying the influence of gender on the TT scores, the statistical analyses were repeated separately for each gender with the same variables except for gender. Statistical significance was accepted for $p<0.05$ and a significant tendency for $p<0.10$.

Secondly, multivariate logistic regression was performed for only the parameters which were significant or had a significant tendency in the univariate analysis in order to identify independent predictive factors of TT score decrease at the two-year follow-up. After analyzing the role of sex, the multivariate logistic regression analysis was repeated separately for each sex with the same variables. In order to achieve multivariate logistic regression, a reference group (RG) was defined for each variable included in the model.

RESULTS

The 344 participants enrolled underwent two motor assessments, one at inclusion and one two years later. In the entire population there were 307 subjects in the "TT no-deterioration" group and 37 subjects in the "TT deterioration" group. Among the men there were 211 subjects in the "TT no-deterioration" group and 17 subjects in the "TT deterioration" group. Among the women there were 96 subjects in the "TT no-deterioration" group and 20 subjects in the "TT deterioration" group. The mean values of the TT score for all participants (344 subjects) were 21.4±1.8 at inclusion and 21.2±1.9 after two years.

First this study found that the TT score at inclusion was significantly higher in subjects whose TT score at the two-year follow-up had not fallen than in those who showed a reduction in TT score ($p<0.0001$): in the entire population (mean TT scores: 21.9±0.7 in the "TT no-deterioration" group and 17.2±2.4 in the "TT deterioration" group), in the men (22.0±0.3 and 17.6±2.5, respectively), and in the women (21.8±1.2 and 16.8±2.4, respectively).

The results of the univariate analysis are reported in Table 1. One of these findings is that female sex was a significant factor of reduced TT scores ($p=0.006$); indeed, women made up 31.3% of the "TT no-deterioration" group and 46.0% of the "TT deterioration" group. In addition, the statistical analysis of the entire population found that the following factors had negative impact on TT scores: advanced age (mean: 63.3±4.0 years for the "TT no-deterioration" group and 64.4±4.3 for the "TT deterioration" group, $p=0.05$), osteoarticular pain (31.6% of subjects with pain for the "TT no-deterioration" group and 68.6% for the "TT deterioration" group, $p<0.0001$), and a high level of anxiety at inclusion (anxiety score: 1.6±1.5 for the "TT no-deterioration" group and 2.2±1.5 for the "TT deterioration" group, $p=0.02$). In the men, the factors which had negative impact on the TT scores were: advanced age (mean: 63.0±4.0 for the "TT no-deterioration" group and 63.5±4.0 for the "TT deterioration" group, $p=0.01$), osteoarticular pain (29.0% of subjects with pain for the "TT no-deterioration" group and 62.5% for the "TT deterioration" group, $p=0.005$), and a high level of anxiety at inclusion (anxiety score: 1.4±1.4 for the "TT no-deterioration" group and 2.2±1.4 for the "TT deterioration" group, $p=0.02$). Finally, in the women, the factors which had a negative impact on the TT scores were: a high BMI (23.3±3.4 for the "TT no-deterioration" group and 25.7±3.9 for the "TT deterioration" group, $p=0.003$), osteoarticular pain at inclusion (37.2% of subjects with pain for the "TT no-deterioration" group and 73.7% for the "TT deterioration" group, $p=0.004$), and the consumption of at least three types of drugs per day (14.9% of consumers of at least three types of drugs per day in the "TT no-deterioration" group and 40.0% in the "TT deterioration" group, $p=0.02$).

Social isolation, physical exercise, tobacco and alcohol consumption, visual disorders, hearing disorders, dependency the Neugarten score, antihypertensive and psychotropic drug use, blood pressure, glycemia, and cholesterol were not significantly associated with TT score decrease.

In order to identify determinant predictors of reduced TT score, the analyses were supplemented by multivariate logistic regression. The results, including odds ratios (*OR*) and confidence intervals (*CI*), concerning these analyses are reported in Table 2. A significant effect of sex was observed in the decrease in TT score. Compared with men, women had a high risk of lower TT score (*OR*=3.7, $p=0.02$). In the entire population, other significant determinant factors of reduced TT score were age (RG: <65 years, *OR*=2.7 for subjects aged 65-69 and 5.2 for subjects aged 70 or over, $p=0.01$),

PERSONAL USE ONLY

This copy is for personal use only - distribution prohibited.

Electronic PDF security powered by IndexCopernicus.com

Table 1. Comparison of the "Tinetti test (TT) no-deterioration" and the "TT deterioration" groups concerning the demographic, social, clinical, psychological, and biological parameters.

Parameter at inclusion	Comparaison of the two groups according with the Tinetti test score decrease in the two sexes and in each sex								
	Men and women			Men			Women		
	TT no-deterioration n=307	TT deterioration n=37	*p*	TT no-deterioration n=211	TT deterioration n=17	*p*	TT no-deterioration n=96	TT deterioration n=20	*p*
Women*	31.3	46.0	0.006						
Age (years)**	63.3±4.0	64.4±4.3	0.05	63.0±4.0	63.5±4.0	0.01	63.0±4.0	63.7±4.0	0.50
Social isolation -living alone*	22.1	23.3	0.15	11.5	7.7	0.27	45.0	35.3	0.42
Professional activity (yes)*	2.0	5.9	0.34	1.5	0.0	1.00	3.3	12.5	0.31
Financial problems (yes)*	26.3	25.0	0.87	28.0	18.8	0.57	22.3	30.0	0.56
Physical exercise (yes)*	56.6	44.4	0.17	56.2	50.0	0.63	57.5	40.0	0.15
Tobacco consumption*									
No smoker	50.3	63.9	0.27	41.4	43.8	0.32	70.2	80.0	0.53
Ex-smoker	34.5	22.2		40.5	25.0		21.3	20.0	
Smoker	15.1	13.9		18.0	31.3		8.5	0.0	
Alcohol consumption*									
No alcohol	20.4	36.1	0.10	15.2	31.3	0.19	31.9	40.0	0.92
Light drinker	42.8	25.0		52.4	31.3		21.3	20.0	
Medium drinker	18.8	22.2		10.5	6.3		37.2	35.0	
Heavy drinker	18.0	16.7		21.9	31.3		9.6	5.0	
BMI (kg/m^2)**	25.1±3.3	25.9±3.8	0.14	25.9±2.9	26.3±3.7	0.59	23.3±3.4	25.7±3.9	0.003
Osteoarticular pain*	31.6	68.6	<0.0001	29.0	62.5	0.005	37.2	73.7	0.004
Visual disorder(s) (yes)*	20.3	17.1	0.66	19.8	20.0	1.00	21.3	15.0	0.76
Hearing disorders (yes)*	3.7	5.6	0.64	2.9	0.0	1.00	5.4	10.0	0.61
Dependence score**	1.7±1.5	2.0±1.5	0.29	1.6±1.5	1.7±1.3	0.77	2.0±1.6	2.3±1.7	0.58
Anxiety score**	1.6±1.5	2.2±1.5	0.02	1.4±1.4	2.2±1.4	0.02	2.2±1.5	2.2±1.6	0.87
Neugarten score**	3.8±1.4	3.6±1.4	0.46	3.9±1.3	3.9±1.4	0.84	3.4±1.5	3.3±1.4	0.93
Drug type number*									
<3	83.9	75.0	0.18	83.3	93.8	0.48	85.1	60.0	0.02
≥3	16.1	25.0		16.7	6.2		14.9	40.0	
Antihypertensive drug consumers*	16.8	22.2	0.41	19.1	18.8	1.00	11.7	25.0	0.15
Psychotropic drug consumers*	47.7	47.1	0.95	40.2	25.0	0.23	64.5	66.7	0.86
SBP (mm Hg)**	135.1±12.1	134.5±14.8	0.86	137.9±11.5	135.8±10.3	0.59	128.9±11.2	133.1±19.5	0.57
DBP (mm Hg)**	81.1±7.1	80.6±5.6	0.78	82.0± 6.8	82.2±6.7	0.93	79.0±7.4	78.8±3.5	0.93
Glycemia** (mmol/l)	6.1±0.8	6.6±2.0	0.29	6.2±0.8	7.4±2.5	0.21	5.9± 0.6	5.8±0.4	0.76
Cholesterol** (mmol/l)	6.1±1.0	6.4±1.1	0.18	6.0±0.9	6.2±0.5	0.55	6.3±1.0	6.7±1.6	0.33

* percentage; ** mean ±SD; p-values for c2 or Fisher tests (qualitative parameters) and for Student's t-test (quantitative parameters).
BMI – body mass index; SBP – systolic blood pressure; DBP – diastolic blood pressure.

PERSONAL USE ONLY
This copy is for personal use only - distribution prohibited.
Electronic PDF security powered by IndexCopernicus.com

Table 2. Multivariate logistic regression analysis: Risk factors of reduced Tinetti test score after a two-year follow-up. The model only includes parameters which were significant or had a significant tendency after statistical analysis.

Parameter	Tinetti					
	Men and women		Men		Women	
	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*
Sex		0.02				
Men	1.0 (RG)					
Women	3.7 (1.6–8.3)					
Age (years)		0.01		0.005		
<65	1.0 (RG)		1.0 (RG)			
65–70	2.7 (1.1–6.5)		5.4 (1.6–18.3)			
≥70	5.2 (1.5–17.6)		6.1 (1.3–29.0)			
BMI (kg/m^2)		0.04				0.03
<25	1.0 (RG)				1.0 (RG)	
≥25	1.1 (1.0–1.3)				1.2 (1.0–1.3)	
Osteoarticular pain		<0.0001				0.004
No	1.0 (RG)				1.0 (RG)	
Yes	4.1 (1.8–9.1)				3.8 (1.2–11.8)	
Anxiety				0.02		
No			1.0 (RG)			
Yes			3.6 (1.2–11.3)			

OR – odds ration; CI – confidence interval; RG – reference group; BMI – body mass index.

BMI (*OR*=1.1 for a BMI of 25 or more, *p*=0.04), and osteoarticular pain (*OR*=4.1 for subjects with pain *p*<0.0001). In the men, age (*OR*=5.4 for subjects aged 65-69 and 6.1 for subjects aged 70 or over, *p*=0.005) and anxiety (*OR*=3.6 for subjects with anxiety, *p*=0.02) were significant determinant factors in the decrease in TT score, while in women, BMI (*OR*=1.2 for BMI >25, *p*=0.03) and osteoarticular pain (*OR*=3.8 for subjects with pain, *p*=0.004) were significant. Other parameters included in the model had no impact on decreases in TT score at the two-year follow-up.

Discussion

The aim of this longitudinal study conducted in a population of 344 young elderly people was to identify among selected parameters those which could influence the TT score decrease at a two-year follow-up. To our knowledge this is the first study in the literature which investigates the demographic, social, clinical, psychological, and biological parameters that have impact on TT in elderly subjects.

The TT appeared to be suitable for the assessment and follow-up of the balance and gait capacities of young elderly people without frailty. These young elderly subjects were independent or only slightly dependent; indeed, their dependency scores were very low. The results of this study showed that the factors associated with a decrease in balance and/or gait are female sex, advanced age, high BMI, osteoarticular pain, and anxiety. In the entire population, in the men alone and in the women alone the TT scores at inclusion were significantly lower in subjects whose scores fell over the two years compared with those whose scores remained stable. The existence of balance and gait disorders thus appears to be the principal risk factor of their worsening. This is not surprising because it has been described in the literature that balance and gait disorders are predictive of balance, gait, and TT score decrease [5].

According to the findings of this study, women were more likely than men to experience a deterioration in balance and gait (*OR*=3.7). To elucidate this gender-related difference, previous studies found that elderly women had less physical strength than elderly men [14] and that there were differences in body composition [15]. Other explanations, such as biomechanical (weight distribution, body alignment) and musculoskeletal factors, could be put forward; nevertheless, these need to be confirmed by future research [16].

A positive association between advanced age and reduced TT score was found in the entire population and in the men. This result is in accordance with data in the literature; it has been established that the prevalence and the severity of balance and gait disorders increase with ageing [1–4]. Indeed, balance control is dependent upon the quality of sensory input from the vestibular, visual, and somatosensory systems, the central integration of informa-

PERSONAL USE ONLY
This copy is for personal use only - distribution prohibited.
Electronic PDF security powered by IndexCopernicus.com

tion and neuromuscular responses [17]. With advancing age, changes related to normal aging and those associated with diseases and their treatments can affect these regulating systems of balance and posture [6]. However, there was no association between advanced age and TT score decrease in the women.

This study has also shown that a high BMI is a predictive factor (with a significant *p*-value or a significant trend in *p*-value) of a reduction in TT score in the entire population and in women: in the entire population and in women, the greater the degree of overweight, the faster the deterioration in balance and gait. Obesity is associated with a decrease in the quality of both muscles (excess of adipocytes, reduced number of muscle cells) and articulations, inducing deterioration in the efficiency of propioception and effectors [18,19]. Obese subjects have a higher risk of metabolic (glycoregulation anomalies) and cardiovascular (high blood pressure, arteriosclerosis) problems than do normal-weight subjects, and these disorders can entail balance and gait impairments and falls [20,21]. However, our study found no impact of BMI on the TT scores in men.

We also found that osteoarticular pain was predictive of a deterioration in balance and gait. Pain, in particular osteoaticular pain, is associated with difficulties in accomplishing motor activities, including gait, as has been reported in the literature [22]. The resulting absence of regular exercise of the lower limbs leads to a reduction in muscle strength [17] and to balance and gait disturbances. Then a vicious circle involving osteoarticular pain and balance and gait disorders can appear. There is another explanation for the relationship between osteoarticular pain and balance and gait impairments. Indeed, osteoarticular pain in elderly people without traumatism is frequently associated with osteoarthritis, which entails loss of both mechanoreceptors and the efficiency of efferent systems. Thus the deterioration of joint propioception in older subjects could induce balance impairment [6]. Furthermore, joint diseases, including osteoarthritis of the hip, can alter gait [23,24], and the results concerning BMI and osteoarticular pain could be linked: obesity is indeed a risk factor of osteoarthritis, especially of the knee, which causes pain [25].

However, in this study, there was no relationship between physical exercise and TT score decrease. This result appears surprising. Indeed, the role of physical exercise in the preservation of balance and gait abilities is now proven by clinic trials [26]. The absence of any impact of physical exercise on balance and gait decline in the present study could be explained by the fact that the questions concerning the practice of physical activity were not precise enough, as the intensity of physical activity was not specified. Furthermore, this absence of a link between the practice of physical exercise and future TT score at two years in this study could be due to the lack of a follow-up of the practice of physical exercise over the two years. Indeed, subjects may have changed their practice of physical activity, so those who declared, at the baseline, to have regular physical activity could have reduced or stopped any physical activity during the study.

Another interesting result concerns the level of anxiety. Except in women, univariate analyses showed that the anxiety level was higher in subjects with reduced TT scores than in those with stable TT scores. Anxiety is often associated with depression, which has been proven to be a risk factor for balance disorders and gait disturbances, such as reduced stride length, double-limb support, and low walking speed [27,28].

Contrary to other research, mainly concerning falls, in the present study the consumption of psychotropic drugs was not associated with a deterioration in TT scores. Indeed, it has been reported that regular consumption of psychotropic drugs is associated with an increased risk of falling in elderly people [29]. To explain this association, the impact of psychotropic drugs on cerebral functions and the reduced metabolic capacity and renal activity due to ageing were put forward [29]. This absence of association in the present study could be linked to the fact that the subjects included were young elderly people (average age: 63 years). Another explanation for our finding could be the fact that the duration of psychotropic drug use was not specified and there was no distinction between the various categories of psychotropic drugs and their respective half-lives.

Social isolation was not found to be a predictive factor of deterioration in TT scores. This could be explained by the fact that young elderly subjects were included in the study and social isolation was unlikely as they were involved in everyday activities, for example shopping for meals. Indeed, in this study, social isolation meant the absence of relations with family and his/her friends and the absence of occupational social activities. Moreover, nobody knows if the subjects who were not socially isolated at the baseline became isolated over the two years of the study; this can also account for the absence of a link between social isolation at inclusion and decreased TT score.

Finally, the absence of any relationship between visual disorders and balance or gait is also surprising. According to previous research, visual impairments may affect equilibrium and gait performance [30]. However, visual disorders may have been stable during the present study, thus accounting for the absence of any influence on the future TT score.

The fact that two of the five factors found to have an impact on TT score decrease, i.e. female sex and advanced age, are not modifiable could constitute a limitation of this study. However, the detection of predictive factors, even non-modifiable ones, is important in order to anticipate balance and gait decline. Indeed, early identification of individuals with high risk could help clinicians to prescribe a specific management, such as an adapted physiotherapy, or regular physical exercise such as tai chi [31] in order to improve their balance and gait and thus their quality of life even if there is no possible direct management of the risk factor. Interestingly, the other three factors (high BMI, osteoarticular pain, and anxiety) could be modifiable or compensated for.

Conclusions

This prospective study has shown that female sex, advancing age, the prior existence of osteoarticular pain, overweight, and anxiety had an impact on balance and gait decline as assessed by the TT. Our findings may be of some interest to clinicians in the context of prevention since they identi-

PERSONAL USE ONLY

This copy is for personal use only - distribution prohibited.

Electronic PDF security powered by IndexCopernicus.com

fy several clinical and social factors which may increase balance and gait impairments in young elderly people.

Acknowledgements

The authors thank the staff of the "Investigations Préventives et Cliniques" (IPC) center, the staff of the "Observatoire De l'Age" (ODA), M. Ph. Bastable, and M. J. Morcet.

REFERENCES:

1. Salthouse TA, Somberg BL: Time-accuracy relationships in young and old adults. J Gerontol, 1982; 37: 349–53
2. Maki BE, Holliday PJ, Topper AK: A prospective study of postural balance and risk of falling in an ambulatory and independent elderly population. J Gerontol, 1994; 49: M72–84
3. Mourey F, Pozzo T, Rouhier-Marcer I, Didier JP: A kinematic comparison between elderly and young subjects standing up from and sitting down in a chair. Age Ageing, 1998; 27: 137–46
4. Rankin JK, Woollacott MH, Shumway-Cook A, Brown LA: Cognitive influence on postural stability: a neuromuscular analysis in young and older adults. J Gerontol A Biol Sci Med Sci, 2000; 55A: M112–19
5. Baloh RW, Ying SH, Jacobson KM: A longitudinal study of gait and balance dysfunction in normal older people. Ach Neurol, 2003; 60: 835–39
6. Matsumura BA, Ambrose AF: Balance in the elderly. Clin Geriatr Med, 2006; 22: 395–412
7. Tinetti ME, Williams CS: Falls, injuries, and the risk of admission to a nursing home. N Engl J Med, 1997; 337: 1279–84
8. Sattin RW: Falls among older persons: a public health perspective. Annu Rev Public Health, 1992; 13: 489–508
9. Tinetti ME, Doucette J, Claus E, Marottoli R: Risk factors for serious injury during falls by older persons in the community. J Am Geriatr Soc, 1995; 43: 1214–21
10. Moreland J, Richardson J, Chan DH et al: Evidence-based guidelines for the secondary prevention of falls in older adults. Gerontology, 2003; 49: 93–116
11. Tinetti ME: Performance-oriented assessment of mobility problems in elderly patients. J Am Geriatr Soc, 1986; 34: 119–26
12. Raîche M, Hébert R, Prince F, Corriveau H: Screening older adults at risk of falling with the Tinetti balance scale. Lancet, 2000; 356: 1001–2
13. Neugarten BL, Havighurst RJ, Tobin SS: The measurement of life satisfaction. J Gerontol, 1961; 16: 134–43
14. Aniansson A, Grimby G, Rundgren A: Isometric and isokinetic quadriceps muscle strength in 70-year-old men and women. Scand J Rehabil Med, 1980; 12: 161–68
15. Heymsfield SB, Wang J, Kehayias J et al: Chemical determination of human body density *in vivo*: relevance to hydrodensitometry. Am J Clin Nutr, 1989; 50: 1282–89
16. Wolfson L, Whipple R, Derby CA et al: Gender differences in the balance of healthy elderly as demonstrated by dynamic posturography. J Gerontol, 1994; 49: M160–67
17. Hinman RS, Bennell KL, Metcalf BR, Crossley KM: Balance impairments in individuals with symptomatic knee osteoarthritis: a comparison with matched controls using clinical tests. Rheumatology, 2002; 41: 1388–94
18. Jensen GL: Obesity and functional decline: epidemiology and geriatric consequences. Clin Geriatr Med, 2005; 21: 677–87
19. Villareal DT, Apovian CM, Kushner RF, Klein S; American Society for Nutrition; NAASO, The Obesity Society. Obesity in older adults: technical review and position statement of the American Society for Nutrition and NAASO, The Obesity Society. Am J Clin Nutr, 2005; 82: 923–34
20. Schwartz AV, Hillier TA, Sellmeyer DE et al: Older women with diabetes have a higher risk of falls: a prospective study. Diabetes Care, 2002; 25: 1749–54
21. Hausdorff JM, Herman T, Baltadjieva R et al: Balance and gait in older adults with systemic hypertension. Am J Cardiol, 2003; 91: 643–45
22. Alexander NB, Goldberg A: gait disorders: search for multiple causes. Cleve Clin J Med, 2005; 72: 586–600
23. Lim MR, Huang RC, Wu A et al: Evaluation of the elderly patient with an abnormal gait. J Am Acad Orthop Surg, 2007; 15: 107–17
24. Cichy B, Wilk M: Gait analysis in osteoarthritis of the hip. Med Sci Monit, 2006; 12(12): CR507–13
25. Englund M, Lohmander LS: Risk factors for symptomatic knee osteoarthritis fifteen to twenty-two years after meniscectomy. Arthritis Rheum, 2004; 50: 2811–19
26. Barnett A, Smith B, Lord SR et al: Community-based group exercise improves balance and reduces falls in at-risk older people: a randomised controlled trial. Age Ageing, 2003; 32: 407–14
27. Lemke MR, Wendorff T, Mieth B et al: Spatiotemporal gait patterns during over ground locomotion in major depression compared with healthy controls. J Psychiatr Res, 2000; 34: 277–83
28. Turcu A, Toubin S, Mourey F et al: Falls and Depression in Older People. Gerontology, 2004; 50: 303–8
29. Kelly KD, Pickett W, Yiannakoulias N et al: Medication use and falls in community-dwelling older persons. Age Ageing, 2003; 32: 503–9
30. Montero-Odasso M, Schapira M, Duque G et al: Gait disorders are associated with non-cardiovascular falls in elderly people. A preliminary study. BMC Geriatrics, 2005; 5: 15
31. Yang Y, Verkuilen JV, Rosengren KS et al: Effect of combined Taiji and Qigong training on balance mechanisms: A randomized controlled trial of older adults. Med Sci Monit, 2007; 13(8): CR339–48

PERSONAL USE ONLY

This copy is for personal use only - distribution prohibited.
Electronic PDF security powered by IndexCopernicus.com

www.IndexCopernicus.com

One Stop Shop in Science

- Scientists networking & collaboration
- Online Research Team
- Scientists profiles
- Individual career monitor
- Personalized information delivery
- Information intergration: literature/grants/patents/jobs

INDEX COPERNICUS

Index Copernicus International Plc.

International Office: 415 Madison Ave., 14th Floor, New York , NY 10017, U.S.A.
phone +1 (646) 673-8415, fax +1 (646) 673-8414

European Office: Ustrzycka 11, 01-141 Warsaw, Poland
phone +48 (0)22 868 1265, fax +48 (0)22 868 1273

e-mail: office@IndexCopernicus.com

Electronic PDF security powered by IndexCopernicus.com

This copy is for personal use only - distribution prohibited.