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Analysis of patients with dementia: Use of computer tomographic and vascular risk

Análisis de pacientes con demencia: Uso de tomografía computarizada y riesgo vascular

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Abstract

Background: The diagnosis of dementia is complicated due to the frequent coexistence of degenerative changes and the lack of uniformity in diagnostic criteria. Objective: To determine the correlation between computed tomography and risk factors in patients with dementia. Methods: 100 patients with a diagnosis of senile dementia, vascular dementia, or Alzheimer's disease were studied. Vascular risk factors included diabetes mellitus, hypertension, cerebrovascular disease, and hypercholesterolemia. CT scans and Hachinski Ischemic scores were recorded. Results: A total of 100 patients (69 women, 31 men) with the prevalence of dementia were studied. The average for women was 79.81 ± 8.2 years. Metabolic concentrations were of no significant value, provided 56% had risk factors such as hypertension. Symptom onset was recorded at 41.39 ± 30.08 months. Computed tomography revealed that 16 % presented signs of ischemia, 12 % cortico-subcortical atrophy, 1 % infarction, and 1% were detected with signs of frontal-parietal flattening. Conclusions: It is possible to use computed tomography in conjunction with vascular risk factors to detect cognitive impairment.

Alzheimer's disease, Hachinski scale, Dementia, Vascular risk, Computed tomographic

Resumen

Antecedentes: El diagnóstico de la demencia es complicado debido a la frecuente coexistencia de cambios degenerativos y a la falta de uniformidad en los criterios diagnósticos. Objetivo: Determinar la correlación entre la tomografía computarizada y los factores de riesgo en pacientes con demencia. Métodos: Se estudiaron 100 pacientes con diagnóstico de demencia senil, demencia vascular o enfermedad de Alzheimer. Los factores de riesgo vascular incluían diabetes mellitus, hipertensión, enfermedad cerebrovascular e hipercolesterolemia. Se registraron las tomografías computarizadas y las puntuaciones isquémicas de Hachinski. Resultados: Se estudió a un total de 100 pacientes (69 mujeres, 31 hombres) con prevalencia de demencia. La media de las mujeres era de 79,81 ± 8,2 años. Las concentraciones metabólicas no tenían valor significativo, siempre que el 56% presentara factores de riesgo como hipertensión. El inicio de los síntomas se registró a los 41,39 ± 30,08 meses. La tomografía computarizada reveló que el 16 % presentaba signos de isquemia, el 12 % atrofia cortico-subcortical, el 1 % infarto y en el 1 % se detectaron signos de aplanamiento fronto-parietal. Conclusiones: Es posible utilizar la tomografía computarizada junto con los factores de riesgo vascular para detectar deterioro cognitivo.

Enfermedad de Alzheimer, Escala de Hachinski, Demencia, Riesgo vascular, Tomografía computarizada

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Introduction

Dementia refers to a chronically progressive syndrome, characterized by cognitive impairment beyond that could be a consequence of normal aging (1). Mild cognitive impairment is defined as a discreet loss of memory, and in some cases, loss of other abilities (2).

In cases where dementia is present, a person's ability to function normally is minimized due to memory, thought process, orientation, comprehension, calculation, learning capacity, language, and judgment are affected (3). The prevalence of dementia increases exponentially with advancing age, affecting 5 % of the population older than 65 years (4, 5), and up to 40 – 50 % of those older than 90 years (6). However, previous studies have presented evidence that the incidence decreases in patients (≥ 85 years) from developed countries.

Alzheimer's disease (AD) is the most common type of dementia in subjects older than 75 years. In Mexico, a study identified a prevalence of 7.3 % and an incidence rate of 27.3 (1,000 people / year) (7). Vascular dementia, the second most common form of dementia, represents 15 % of reported cases (8). Regarding the life expectancy of AD patients, those diagnosed before 75 years of age tend to live longer than those diagnosed at a later stage of their life (9).

A wide range of risk factors should be considered for dementia (genetic, vascular, metabolic, and lifestyle choices), as well as for the interactions between these (10); it is likely that a large proportion of variance in dementia related risk factors remains unexplained. Therefore, there is an urgent need to identify further potentially modifiable risk factors for dementia (11).

The use of structural neuroimaging is widely accepted by the Spanish Society of Neurology and the American Academy of Neurology. Existing evidence demonstrates how structural neuroimaging has an impact on the patient's treatment during an initial evaluation of dementia. For patients under the age of 65 years, the presence of focal neurological deficits and a short course of cognitive degeneration (less than one year), make neuroimaging techniques much more useful (12).

Furthermore, neuroimaging techniques can also be used to differentiate between subtypes of dementia (like vascular diseases, Alzheimer's disease, etc.). The Hachinski Ischemic score (HIS) scale is known to be a simple clinical tool used to differentiate between these main types of dementia and is still being continuously and extensively used for this purpose. However, investigations on the usefulness of HIS are scarce (13, 14).

As far as it is known, in Mexico, there are no reported studies on risk factors in patients with dementia and their interrelation with results of computed tomography. For this reason, the specific aim of this study was to determine the relationship between computed tomography and risk factors in patients diagnosed with dementia.

Material and methods

A descriptive and observational study was conducted on 100 patients from the General Zonal Hospital and Family Medicine No. 21 (HGZC/MF 21) in Leon, the major densely populated city in the state of Guanajuato, Mexico. Length of the period of admission considered was 12 months. All cases indicated a presumptive diagnosis of senile dementia: including vascular or Alzheimer type dementia.

Participants

The following criteria of inclusion were applied to patients in the HGZC/MF 21: (a) age greater than 60 years regardless of gender, loss of memory, progressive personality changes, and language disorders; (b) each patient underwent detailed clinical assessment and a mild cognitive impairment test. Patients with acute confusion syndrome, organic mental disorders (functional or metabolic) that could lead to acute mental confusion, and finally, systemic infection or any type of contagious infection, were all excluded.

During the initial interview, patients were informed about the study. If the clinical status and/or the cognitive status of the patient did not enable informed consent, the interviewer contacted the subject's representative. All participants signed and informed consent forms and were considered for the study with reference to the Helsinki Declaration. The study protocol was approved by the concerned Hospital's Local Research and Ethics Committee on Health.

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ID forms for every patient were filled with such variables as age, gender, schooling, occupation, marital status, family history of dementia, risk factors, clinical picture, sleep disorders, metabolite concentrations, CT scans, and application of certain scales used to diagnose dementia.

The Hachinski ischemic score (15) consists of thirteen items, each with a specific score: abrupt onset (2 points), stepwise deterioration (1 point), fluctuating course (2 points), nocturnal confusion (1 point), preservation of personality (1 point), depression (1 point), somatic complaints (1 point), emotional incontinence (1 point), history of systemic arterial hypertension (1 point) , history of strokes (2 points), evidence of associated atherosclerosis (1 point), focal neurological symptoms (2 points), and focal neurological signs (2 points). A score of 0 - 4 points classify a patient with AD, scores from 5 to 6 determines mixed dementia, and patients scoring 7 or greater are diagnosed with vascular dementia (VD). We chose this scale to define the presence or absence of VD since it has already been validated in our language, has an adequate sensitivity (89 %) and specificity (89 %) (15), and is easily applied in 10 minutes.

Diagnosis according to the HIS scale was correlated with the diagnosis described in the file of each patient by the attending physician. Results obtained from computed tomography of each patient were then collected to the study.

Statistical analyses

Normality was assessed using the Kolmogorov-Smirnov test. An independent *t*-test was used to find associations between vascular risk factors and CT scans. P values were calculated using an independent *t*-test between the means of HIS from participants with described factors and from participants without the described factors. Additionally, the Pearson correlation coefficient was used to further assess correlation between the vascular risk factors and CT scans. To verify results, simple and multiple linear regression analyses were performed. Initial analyses were carried out to clarify the association between vascular risk factors and CT scans.

Data was expressed as mean ± standard deviation for continuous variables and as frequency and percentage for categorical variables. Statistical significance was evaluated with a two-sided significance level of 0.05. All statistical analyses were performed with Statistics 19.0 (IBM Corp., Armonk, NY, USA).

Results

In the study, a total of 100 patients were reviewed along with their records of presumptive diagnosis of senile dementia, Alzheimer type dementia, degenerative dementia, or vascular dementia. Women present in this study were more in number, representing 69 % of all subjects (31 % were men). Ages of participants ranged from 60 to 95 years.

Table 1 shows general characteristics, risk factors and metabolite concentrations. The mean age of participants was 79.8 ± 8.2 years old. As for the onset of symptoms, a mean of 41.3 ± 30.08 months was calculated and 13% of participants had a family history with dementia.

As for metabolite concentrations, the mean value of glucose was 69.7 ± 44.1, cholesterol 133.7 ± 97.2, triglycerides 159.06 ± 62.90, C-HDL 60.90 ± 8.08 and for No-HDL a mean value of 100.08 ± 27.4 was found.

From the risk factors report, we found that 34 % presented with alcoholism and 32 % were smokers. The remaining 34 % had no reported drug dependence. Other risk factors, such as systemic arterial hypertension, was present in 56 %, diabetes mellitus in 41 %, cerebrovascular disease in 27 % and dyslipidemias in 10 %.

Sleep disorders such as frequent awakening (52 %), insomnia (42 %), and fragmented sleep (6 %) can be observed in Table 2. The average between CT and risk factors are presented in Table 3. Patients who had a CT are observed to present most frequently one single risk factor, the record specifically being 16 out of 30.

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Characteristics	Number (percentage)
Women	61 %
Men	39 %
Age (mean ± SD)	79.81 ± 8.27
Schooling in years (mean ± SD)	5.03 ± 2.07
Onset of symptoms (months)	41.39 ± 30.08
Family history of dementia (%)	13(13)
Family history of stroke (%)	27(27)
Glucose (mg/dl)	69.72 ± 44.11
Cholesterol (mg/dl)	133.71 ± 97.22
Triglicéridos (mg/dl)	159.06 ± 62.92
C-HDL (mg/dl)	60.9 ± 8.08
No C-HDL (mg/dl)	100.08 ± 27.45
Hypertension (%)	56 (56)
Diabetes mellitus (%)	41 (41)
CVD (%)	27 (27)
Dyslipidemia (%)	10 (10)
Alcoholism (%)	34 (34)
Smoking (%)	32 (32)
CT (%)	30 (30)
No CT (%)	70 (70)

SD (standard deviation); C-HDL (No C-HDL); DVC (Cerebral vascular disease); CT (computed tomography); No CT (No computed tomography).

Table 1 Demographic characteristics, vascular risk factors and metabolite concentrations in patients (n = 100)

Sleep disorders	%(percentage)
Frequent awakening	52
Insomnio	42
Fragmented dream	6

Table 2 Sleep disorders in 100 patients admitted into HGZMF 21

From Table 4, CT tests revealed that 16 % presented signs of ischemia, 12 % cortico-subcortical atrophy, 1 % infarction, and 1 % signs of frontal-parietal flattening.

The Hachinski scale scores are reported in Table 5. As previously mentioned, a score between 0 and 4 classified patients with Alzheimer's disease, 5-6 refers to mixed dementia, and 7 or greater indicates vascular dementia. The most common score was 5 (34 patients).

	Total	No risk factor	A risk factor	Two risk factors	Three risk factors	Four risk factors
CT	30	3 (10%)	16(53.3%)	9 (30 %)	2(6.66 %)	0
No CT	70	7 (10%)	35 (50%)	25(35.71 %)	3 (4.28 %)	0

Computed tomography (CT) No Computed tomography (No CT) risk factors (Hypertension, Diabetes mellitus, cerebrovascular disease, and dyslipidemia).

Table 3 Relationship between CT and vascular factors

Results CT (Computed tomography)	% (percentage)
Ischemia	16
Cortico-subcortical atrophy	12
Frontoparietal planning	1
Heart attack	1

Table 4 Results of the computerized axial tomography for the diagnosis of dementia in 100 patients admitted into HGZC/MF 21

Number of patients	Hachinski Scale Score
1	2
1	3
28	4
34	5
26	6
6	7
3	8
1	9

Table 5 Results of the Hachinski scale when applied to 100 patients from the HGZMF 21

The Hachinski ischemic scale between 0 and 4 classified patients with Alzheimer's disease, 5-6 refers to mixed dementia, and 7 or greater indicates vascular dementia

Finally, Table VI exhibits the association between CT tests and observed risk factors using the Pearson Chi-square test ($\chi^2 =$ 52.17). In general, a level of significance (denoted by α or alpha) of 0.05 works properly.

Variable	Hypertension	Diabetes mellitus	CVD	Dyslipidemia	CT	No CT
Sick	66	41	27	10	32	34
Healthy	44	59	73	90	68	66

Computed tomography (CT) No Computed tomography (No CT) cerebrovascular disease (CVD). Pearson Chi-square test

Table 6 Association between risk factors and patient with con computed tomography

Discussion

Dementia does not present a unique set of symptoms, making it difficult to detect and diagnose it in its early stages (13). In this study, dementia was most frequent in women rather than men, an information which agrees with other authors (16). However, this study group presented an age average of 79 years. Male participants were found to constitute about half of the female participants, reflecting the corresponding longevity of females.

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Studies suggest that the global prevalence of dementia for those older than 60 years is between 5 – 7 %. Additionally, dementia prevalence can be influenced by genetics, lifestyle, and cultural background (17). As for sleep disorders, most of our patients admitted being suffering from frequent awakening, also coinciding with other authors who report that sleep disorders increase the risk of developing dementia since sleep plays a significant role in cognitive processing. Thus, sleep disorders can lead to cognitive impairments in adults (18).

Despite this, other authors remark otherwise since insomnia is one of the most common complaints among the elderly. This lack of relationship between insomnia and dementia is contradictory to the meta-analytic findings by Almondes *et al.* (19), who comment that insomnia increases the risk of developing dementia. The frontal-subcortical pathology associated with circadian rhythm disorders, has been associated with late stages of dementia as well as with early morning awakening. In addition, there is a relationship between the frequency of apnea and the severity of dementia in elders with SDB (sleep-disordered breathing), thus this could be responsible for increasing the risk of developing dementia (20). Cardiovascular load is a risk factor for the development of cognitive dysfunction, as well as for dementia (21).

Risk factors such as hypertension, diabetes mellitus, cerebrovascular disease and dyslipidemias were present in our study, concurring with other studies that report cardiovascular disease, adiposity, stroke, physical inactivity, diabetes, smoking and alcohol intake as known metabolic risk factors (22, 23).

Numerous investigations have shown that the risk of Alzheimer's disease (AD) is increased by the presence of one or an aggregate of cardiovascular (CV) risk factors such as history of type 2 diabetes (T2D), hypertension, smoking, lipid disorders, and cerebrovascular factors (24) Some studies suggest that CV disease (CVD) may affect dementia by the reduction in cerebral blood flow and breakdown of the blood-brain barrier (25) Also cirrhosis, asthma, and diabetes mellitus are all important contributors to cognitive deterioration in the elderly (26).

The present study not only shows differences in dementia prevalence compared to previous studies, but that gender also plays a role in the existing metabolic risk factors. Our results point to an association between hypertension and dementia which agrees with other authors (27-28). Hypertension and dementia are common in the elderly population with prevalence of over 50 % and 5-7 % respectively (29).

An increased risk of dementia has been observed in patients with diabetes mellitus (DM) in various epidemiological studies (30). Our results agree with this view, presenting a correlation between dementia and DM. Moreover, the increased risk of microvascular infarction associated with DM contributes to the increased risk of vascular dementia.

This study was limited by the fact that no complementary scale for diagnosis was applied, our results relying only on the clinical and CT diagnoses.

Conclusions

Complementing CT scans with vascular risk factors in a population with dementia is a feasible technique for detection of cognitive impairment. Nevertheless, the authors consider that the Hachinski Ischemic score alone could be a satisfactory diagnostic tool in this respect.

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Conflict of interest.

The authors declare that have no conflict of interest.

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