UTILITY OF THE CLOCK DRAWING TEST AS COGNITIVE SCREENING IN PATIENTS WITH ARTERIAL HYPERTENSION
(Heart and Brain Study in Argentina)

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Background

1. **HEART and BRAIN CONNECTION**
   - +700 papers support relationship between HTN & Cognition

2. **VASCULAR BRAIN INJURY**
   - WML (White Matter Lesion)
   - Desconnection the pre-frontal cortex
   - Executive Dysfunction
   - 20%-25% conversion to dementia

3. **EPIDEMIOLOGICAL STUDIES in ARGENTINA**
   - 5 Epidemiological studies
   - +3000 hypertensive patients
   - Cognitive impairment
   - Global Cognitive Impairment (MMSE)
   - Executive Dysfunction (CDT)
   - 18%
   - 38%

ESC Congress
Munich 2018
The Background of this study.

1. The heart and brain connection is a fact. In the last 40 years more than 700 papers have supported the relationship between HTN and cognition.

2. HTN is the main cause of vascular brain injury affecting the subcortical white matter (WM) and, depending of the “burden” and "progression" of the WMLs increases the risk for stroke but much more for cognitive impairment (CI). Because, WMLs cut the connection between the subcortical structure and the pre-frontal cortex affecting the executive functions (typically cognitive domain affected in hypertensive patients) such as planning, visuospatial ability, working memory and decision-making. Detecting executive dysfunction is very important, because 20% to 25% of the patients they will convert to dementia within the next years.

3. Five epidemiological studies in Argentina carried out by our group with more than 3000 hypertensive patients concluded that the average prevalence of executive dysfunction (using CDT) is twice of the average prevalence of global cognitive impairment (using MMSE).

Then, due to all these, it is imperative detect CI and especially executive dysfunction in HTN patients.
Purpose/Design/Methods
To compare the utility of two cognitive tests and to know the prevalence of the cognitive impairment in hypertensive patients.

POPULATION
533 Men
882 Women (62%)
Mean age 60 years
Education level 10 yrs.
Average BP 144/84 mm Hg

LOCATIONS
18 Hospitals in Argentina (Heart & Brain study)

TWO INTERVENTIONS
① Mini-Mental Test
② Clock Drawing Test

FIRST ORDER
To write the number inside the circle in order and correct position

SECOND ORDER
Draw the hands on the clock indicating the time “twenty to four”

MMSE 19 questions + 1 drawing
PURPOSE
The purpose of this investigation was to compare two cognitive tests for detecting CI in hypertensive patients.

POPULATION/LOCATION
The Heart and Brain study was done in Argentina by 18 cardiology centres. Included 1414 hypertensive patients (62% were women, the mean age was 60 years old, the education level was 10 years and the average value of the BP was 144/84 mm Hg.

INTERVENTIONS
We applied two tests.
1) Mini-Mental Statement Examination (MMSE) explore the global cognition. It has 19 questions and one drawing but lacks of proof for detecting executive dysfunction and demands 20 minutes to do it.

2) Clock Drawing Test (CDT). We give the participants a piece of paper with a 10 cm diameter circle on it. And then we give two orders: First, write the number inside the circle in order and correct position and after the patients must draw the hands on the clock indicating the time “twenty to four”.

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Clock Drawing test/Abnormal results (examples)

<table>
<thead>
<tr>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
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<tbody>
<tr>
<td><img src="image1" alt="Mild Clocks" /></td>
<td><img src="image2" alt="Moderate Clocks" /></td>
<td><img src="image3" alt="Severe Clocks" /></td>
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CDT ABNORMAL RESULTS (Examples).
In this slide, you can see different examples according to severity of CI executive dysfunctions.

LEFT PANEL
The impairment is mild. Compromise in the spatial organization or planification (the numbers and the center of the hand are not in the correct position) or missing numbers.

MIDDLE PANEL
This is more advanced stage. The time setting is compromised.

RIGHT PANEL
Here, you can see horizontal or vertical alignments of the numbers, inability to draw the hands or more numbers than twelve.
Findings/Results

1414 hypertensive pts.

Cognitive impairment

MMSE 21% (p ns)
CDT 36% (p 0.01)

20% 21%
31% 38%

CDT vs MMSE in hypertensive patients

Abnormal test (%)

Age (years)

<30 30-39 40-49 50-59 60-69 70-79 >80

CDT MMSE
RESULTS or FINDINGS

On 1414 hypertensive patients the prevalence of the cognitive impairment using the MMSE was 21% (without difference between sexes (20% vs 21% p ns) but when we used the CDT was 36% moreover, in this cases the women presented more executive dysfunction than men and this results had statistical significance (38% VS 31% P 0.01).

FIGURE

You can see as the CDT detect cognitive impairment in 25% more than the MMSE in adults and young-adults. But, the difference in the results decrease over time. Possibly due to a greater impairment in other cognitive domains in late-life then, in this case the MMSE can be useful to detect the impairment in other domains.
Conclusions

• The prevalence of the cognitive impairment using the Clock Drawing Test was higher (36%) compared to the Mini-Mental Test (21%).

• Even, the 30% of the hypertensive patients with normal Mini-Mental Test had abnormal Clock Drawing Test result.

• This disparity in the results between two test was greatest in middle aged.

• In addition, this cognitive impairment was more frequent in women than men (38% vs 31%).
Key messages

1. HTN is the cause of vascular damage in the brain and the most important consequence beyond the stroke is cognitive impairment. So much that, HTN was recognized by Alzheimer Disease International as the main modifiable vascular risk factor for dementia.

2. One third of the hypertensive patients suffer cognitive impairment, and the most affected cognitive domain are the executive functions (depend of the integrity of the pre-frontal connection).

3. The clock drawing test detects the executive dysfunction. This is a simple, quick and easy screening test to be applied in the routine clinical practice.
Thank you for your attention